Requisite Foresight in Knowledge Enhanced E-business

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Abstract Requisite variety has influenced concepts of environmental relations of organization for almost half a century. This article develops the concept of 'requisite foresight' on the basis of its roots in cybernetics and extends its applicability to contemporary knowledge management. Organization theory incorporating a temporal aspect and reaching for 'requisite foresight' challenges a dualistic and rigid interpretation of organizational environment. If considered within a network of organizations 'distributed knowledge' paves the way for 'requisite foresight'. A 'foresight' approach explains prevalent perspectives in new e-business applications, like supply chain management and customer relationship management. Concluding, 'requisite foresight' merges strands of reasoning useful to the expansion of organizational models in the knowledge economy.

1. Introduction

In a volatile modern society, institutions are rarely perceived as indisputable providers of answers that guide tomorrow's business decisions. Managers whether in business or in government easily succumb to myopic decisions paralyzed by complexity and uncertainty in a globalizing society. Markets are neither single price markets nor do they structure themselves in well-defined patterns of supply and demand. They are a source of uncertainty and irreversible opportunities leading both manager practitioners and analysts to realize that 'the process by which reliable knowledge may be obtained is a central issue in economic organization' (Hayek, 1945).

From these developments emerge, no less challenging, the question if organizations are dissolving as the erudite best-practice optimizing corrective to fluctuating markets and 'uncertain' societal institutions leaving management with even less of a foundation for decision-making.

The resource-based view of economic organization promises an anchor of decision-making, with the notion of core competencies, known as resources that are more stable and serene than markets and institutions (Wernerfelt, 1984, Prahalad and Hamel, 1990). The resource-based view unfolding in a new level of abstraction beneath production factors, hinting at subtle mechanisms for innovation, yet not explicated as a production function for innovation, brings seeds of evolutionary thinking including irreversibility, temporality and uncertainty to the notion of the firm, now devoid of anonymity as it is drawn into co-operation and affiliation with inter-related firms: Organizations are both interdependent and temporal and so are its management (Richardson, 1972, Loasby, 1999).

The temporal organization has been on the agenda in a recent special issue of The Academy of Management Review (26 (4), October 2001) whereas the knowledge issue was disregarded. In another journal, a special issue on knowledge management support for decision-making was in focus but disregarded the temporal organization (Decision Support Systems 31(1), March 2001). Each issue took departure in its disciplinary focus, i.e. organizational behaviour and decision support information systems respectively. These two strands of thinking need to be merged in a conception of foresight.

Foresight is a temporal issue that synthesizes the managerial challenge of managing knowledge, taking advantage of it in coping with the future to understand and enact change.

A temporal organization lens and a knowledge interchange set the stage for another managerial approach than one based on resources, evolutionary models and transaction cost specific organizational forms (Williamson, 1975, 1985). Though still embryonic, the present e-business infusion into organizations furthers a demise of the dualism of market versus the firm (organization) opening for a discussion of alternative conceptions of organization networks (Pedersen et al., 2002).

Networks are here understood as interactions; co-operative relationships and affiliations between organizations enabling development, co-ordination and transaction of dissimilar but complementary activities, though it is a developing concept not yet mature for any conclusive definition (Alstyne, 1998). Revisiting the issue of foresight could be seen as a conceptual test of a network approach applied to a knowledge infused e-business perspective on economic organizations.

We pursue these issues taking departure in the question, which are the theoretical conditions and requirements to business organization's foresight in a knowledge economy?
Foresight is the focus. Networks, knowledge, organization and decision-making are the components arranged to model the requisite business activities. We do not research if our object of study is an emergent one taking shape according to availability of modern means of communication and collaboration, or if it is an issue entrusted upon business by globalisation or other kinds of forces in the economy.
The argument takes the following course:
Forecasting environmental changes is as old a challenge as organization itself. In distributed information systems, we have taken the first step from forecasting to foresight. In simple terms, we call forecasting the art of predicting the future (i.e. when will X happen) whereas *foresight* refers to the capacity *through* organizational relationships to manage during times of sudden and unpredictable change. While forecasting is highly appreciated (when succeeding), the latter is independent of the former and is a necessary activity of management.
After arguing why and how to extend *requisite variety* into a new context, we suggest a *temporal, inter-organizational* model as the framework for understanding e-business giving weight to the extension of inter-organization processes into *distributed knowledge systems*. These systems, we argue, emerge from the interactivity of networks in each and every business organization and in all economic and social sectors of modern society. Networked organizations outperform any vertically integrated and centralized organization structure. Finally, developing capabilities of information systems (like virtual networks, e-markets, etc.) in business call for a network approach to organizations.
The networks of communication breed knowledge interchange opportunities that cannot be forsaken (requisite activity) by any business facing frequently changing, competitive conditions following streams of innovation in technologies, products, services in inter-organizational collaboration architectures.
Arguing how to breed *requisite foresight* on a distributed knowledge model of inter-organization takes us to the concluding section on challenges to organization theory from ubiquitous or pervasive information systems.

2. The global Internet society: Networked and networking

Numerous publications on the Internet society bear witness to the widespread perception of a new era of modern society, often with subtle connotations of risk, threats to quality of life, disruptions of traditional institutions, etc. None of these reservations are new in the history of major technological innovations. The very occurrence of the preoccupation with technology, however persuasive, should not hide for the fact of an extraordinary fast diffusion (and adoption) of the associated technologies (network access points and computers in the home, schools, libraries, public places, etc.) While previous technologies in communication have been highly centralized in their structure, be they broadcasting or television, the Internet technologies are open standards of a non-centralized and non-concentrated network technology. Though the offspring of military technology, the Internet protocols have become the 'siblings' of

business, government and homes. Everybody 'loves' the Internet, except for those few that feel encouraged by this embrace to oppose and raise a critique.
Ever as exciting the debate about the Internet may be, it will never be brought to conclusion in general terms since there is no definite limits to how applying the Internet (Castells, 2001). This technology now arises from each single computer system being configurable on the fly, susceptible to ever changing needs and requirements, and therefore not subject to one particular 'discourse' but to infinitely many. Maybe we need to give up considering the Internet as an object by itself? Just like 'discussing' electricity makes no sense in modern society whereas discussing recoverable sources of energy does.
Indicating that the way we perceive and approach an issue leaves us with a constrained discourse, the networking of components will displace a component-in-itself-approach. Likewise in this paper, networking takes precedence to one network that takes precedence to any component (node). Considering networking to be less than 'structure' and more than 'agency', the classic dualism of individual vs. society plays no role in the models to be presented here. Networking is not an inactive, analytic category. It is the way acting takes place in a knowledge economy. And requisite foresight takes us to the ultimate reason why: An enhancement of working capital efficiency.

3. Requisite variety

Cybernetics holds it evident that complexity needs to be understood from basic principles acknowledging strong interdependency and complexity and to be scientifically studied using abstract concepts.
Variety in cybernetics is defined as the number of elements in a set. But a "set's variety is not an intrinsic property of a set: the observer and his powers of discrimination may have to be specified if the variety is to be well defined" (Ashby, 1964,7/6). Ashby suggests measuring variety by the logarithm to the number of distinct elements, which is the same approach as that of Shannon and Weaver (1959).
Variety must be seen in relation to constraint since constraint is defined as a relation between two sets, and occurs when the variety that exists under one condition is less than the variety that exists under another" (op.cit.7/9). Ashby adds, "it seems that constraints cannot be classified in any simple way, for they include all cases in which a set, for any reason, is smaller than it might be" (op.cit.7/10).
Regulation is the context of requisite variety in cybernetics, meaning that any system that may be subject to regulation is of more interest to social scientists. If variety is to be affected it is through variety, which means that it takes variety to bring down variety. In regard to regulation, the *law of requisite variety* states that a regulator's capacity as a regulator cannot exceed the regulator's capacity as a channel of communication (op.cit.11/11).
Variety from a biological point of view, Ashby divides into two forms: That which comes in direct transmission to the organism (threatens its gene-pattern) and that, which can be transformed (or re-coded) through the regulator and used to block the effect of the remainder. Requisite variety therefore brings together the variety of a sys-

tem with regulation in face of disturbances or threats coming to the system from outside.
To cope with a dangerous outside world a system needs to be able to capture all those kinds of disturbances that may result in destruction of the system. Developing a regulator, which captures the signals before they reach into the core of the system and apportion an adequate response, ensures a much higher chance of survival than if the system is left unattended to all kinds of impacts from outside. The regulator needs to show a variety no less than the one required to ensure a response to the environment that ensures survival.
This analytic finding is of high interest to our analysis of networks. Yet, we divert from cybernetics for a number of reasons.
Our approach shares with cybernetics two aspects. First, just like cybernetic it adapts an approach where principles lead to understanding and where observations become possible outcomes of many potential ones. No single empirical finding exempts the set of possible findings of a particular "mechanism". Thus, the theory of networks would span a wider set of possible forms than those found in our present empirical studies. For example, "distributed information systems" would encompass every known distributed system but also those yet to be built, at least until we find a basis for distinguishing between varieties of systems and thereby increase our understanding at a higher degree of granularity.
The second inspiration, we derive from Ashby's definition where he states "cybernetics might in fact be defined as the study of systems that are open to energy but closed to information and control – systems that are information tight" (op.cit.1/6). We agree with his idea of studying systems but interpret systems as "networks" that are highly diversified. A system and its components constitute a set. The nodes and their relations do not form a (general) set but a unique architecture or 'constellation' so we follow the reasoning of general systems theory (von Bertalanffy, 1968).
In contrast to Ashby, we consider organizations as systems that have become very open to information due to proliferation of information technologies and even to inter-organizational control reflecting commitments to collaboration and co-ordination across organizational boundaries.
Ashby adopts a probabilistic (Bayesian) basis for his reasoning, yet we keep a firm grip on his idea of requisite variety as a *parable* for knowledge management in a fast changing environment. Rather than interpreting *requisite variety* at the level of bits (log 2) of the state of the world, we suggest to understand variety at a higher level (semantics) fitting to the level of abstraction in knowledge management and our concept of networks. The reason why is to allow for a much more heterogeneous environment than the one of Ashby's. He subjects the environment to the law of equally probable states (Bayesian law) whereas in our model we consider the environment as a function of the system in focus and reflect that the regulator (manager) needs to act to establish, maintain and develop the interdependency with 'the environment'.
Requisite activity takes away the free decision-making of the regulator (manager) because the system irreversibility imposes action in constrained interdependency. The irreversible relations do not decompose into discrete, stable components as far as they are actionable.

Galbraith identified an action prerequisite in information overload, conceiving of organizations as information processing networks, which must find designs to cope with the information challenge either by reducing the overload or increasing the capacity (channel) for information processing. It is apparent that Galbraith reasons in line with requisite variety and state a specific requisite *activity* of information design (Galbraith, 1973).

Argyris and Schön (1978) state the in discussable: Theory in action and espoused theory should not be confused. The dichotomy is constitutive of knowledgeable social interaction and it confirms the conjecture that requisite action is a defining characteristic of organization.

In a network, *requisite activity* of unequal probabilities takes place in a world of irreversibility where timing of activity matters. Activity has to be enacted *before* knowing (subjectively) the opportunities completely (Keynes, 1921, Simon, 1955, Loasby, 1999). Simon's position on decision-making, i.e. satisfying, assumes that having an option is only to get a relatively more satisfying set of information, yet without achieving anything like certainty when the option is exercised (Dixit and Pindyck, 1995). But Simon misses the *requirement* to act. Organizational learning implies this requirement in any organization and therefore informs our model of irreversible, requisite activity (Engeström, 1987; Blackler, 1993).

In this way, the universe of opportunities remains uncertain and subject to historical change as time is 'time with an arrow', therefore organization makes no sense without requisite activity. This analysis (re-) introduces the idea of *cape diem* as an organizational prerequisite in the concept of requisite activity.

Though, we cannot stay close to Ashby's concept of requisite variety. We are inspired to take his keen insight into the realm of a knowledge economy, meaning an economy required to act on a knowledge base that is a highly, though far from equally, dispersed asset of the organization in its related environment (Hayek, 1945, Loasby, 1999).

Trends and discontinuities impact on inter-organizational relations. Internal organizational changes are mostly perceived in terms of managerial decision-making. But both types of change may represent an outcome of organizational foresight! Proactively fitting inter-organizational capacities to environmental changes demands and takes advantage of foresight.

A temporal lens on organization should therefore not stop at the "entrainment of adjusting the pace or cycle of one activity to synchronize with that of another" (Ancona and Chong, 1996) just as knowledge management should not stop at sharing knowledge on the past for best practice. Rather, it should not stop short of applying knowledge to apprehend and preconceive the future, thus generating *foresight*. The fundamental logic of more and more information systems is founded on new opportunities to generate organizational foresight.

We will *transform Ashby's concept of requisite variety into networks of distributed knowledge in an e-business context based on requisite activity to achieve requisite foresight.*

In this paper we blends requisite variety and distributed knowledge systems in network organization.

4. The temporal view of organization and networks

While temporal issues have been around in organization studies for many years the consequence to organization theory is neither coherent nor cogent (Ancona, et al, 2001a). Foresight implies that time creeps into the models one way or another, and therefore raises the question how to conceptualise the aspects of time (Kavanagh and Araujo, 1995). Answering this question we present a view on organization as managed, structured recurrent and interrelated processes, in short a cycle approach, determined by requisite activities.

McGrath and Rotchford (1983) studied leadership decisions on how fast to act and with which external cycles to co-ordinate, for example the adjustment of cycles like the organizational change cycle to company's strategic competitive and technological cycles and coined the concept of *entrainment* to signal a new perspective, which embeds time in organization. Applying the entrainment principle (Ancona and Chong, 1996) we may extend the cycle approach with two network constituting cycles, i.e. a cycle of procurement and a cycle of provision where each cycle complete its objective by intersection with vendors and buyers respectively (Pedersen, 1996).

As the boundary-crossing cycles interrelate, the organization as a network unfolds. In this model, an organization is embedded within networks and the temporal nature of organizations is represented in cycles of processes. This is a perspective now widely adopted in supply chain management and customer relationship management within the field of information systems.

How do requisite activity impact on the organization of knowledge? The conjecture proposes distributed knowledge as an object of study to account for requisite activity in networks.

Tsoukas (1996) adopted a position on the firm as a distributed knowledge system arguing for a knowledge approach to organizational processes. We consider the single firm an insufficient frame for structuring of knowledge looking at organization from the view of networks. This does not preclude the perspective of distributed knowledge within the business processes of a firm in so far as we interpret the knowledge processes within networks rather than within organizational units. Where the knowledge concern is mature in the sense of a high degree of codification users' prerequisites are likely to allow for relatively unconstrained access to knowledge whereas in those circumstances knowledge is 'tacit' there is little sharing in the network of organizations.

Of course, challenging the concept of organization boundary is to challenge the concepts of resources, core competencies and capabilities that are fortifications against the external perspective of the positioning school by Porter. Instead of the fortification and the impact of an external position, *requisite activity* accounts for organizational boundaries as 'activity constructs' constituted by cycles of business processes exchanging knowledge, services, and products in networks. Organization comes with activities and the reverse. Organization cannot exist without activity. *Requisite* activity conjectures that there are claims on the activity, which we meet as business processes and constraints. These have been studied in various contexts.

The distributed knowledge approach is supported by Granstrand et al.'s (1997) reasoning on the proper interpretation of statistical analyses of findings on major US corporations showing distributed competencies rather than just "core" ones; and Met-

calfe and Miles (2000) arguing that innovations are distributed rather than occurring only one place at the time reflecting a distribution of competencies across many organizations rather than as a capsule within one organization.
These studies of innovation and knowledge establish managing distributed knowledge as a prerequisite for corporations to stay at the front of technology based competition. Both the technological knowledge and its proper management reflect that a knowledge-determined, select network is a corporate strategic prerequisite.
A study in competence development revealed a knowledge management strategy with an emphasis upon selecting partners with high impact on competence development in a major engineering consultancy (Pedersen, 1999). Requisite activity to this company meant to invest in particular tenders where attractive business partners from a competence development point of view would take part.
These findings favour a network approach to organization to study foresight based upon distributed knowledge management since neither the selection of distributed competencies nor the selection of project partners for competence development take place accidentally. A kind of foresight is applied.
From our position organizational models of irreversible, yet recurrent processes must be understood in terms of *requisite activity*.
One final organizational component that we want to consider at this stage of the argument is information systems.
We propose that modern business organization has absorbed *information systems* (applications) to such an extent that organizational routines are as much software embedded as they remain embedded in organization structures (Lucas and Baroudi, 1994; Fulk and DeSanctis, 1995). While this may be considered presumptuous at organizational level, it is apparently already the case inter-organizationally. This is due to the fact that all modern corporations conduct consolidation of accounts, stocks and items critical to operations across numerous subsidiaries and business units located nationally and internationally on telecommunication networks - at a minimum using the fax protocol - and nowadays mostly using the Internet transmission protocol while calibrating the organization to take advantage of the technological support (Ghoshal and Bartlett (1990).
Operations internationally have been more profitable than domestic as proven by the fact that World trade rate of growth has been above national rates of growth for most of the years since UN world trade simplification acts were enacted in the 60s (Pedersen, 1992). International trade has brought along a strong demand for means of communication and data transmission. Within a few decades the digital vehicles and devices have become so numerous that organizational support for business has contracted, measured in employee support-staff. Whereas devices have multiplied within the organization, the organizations have become less hierarchical in the process. Business organization has become networked in the wake of this transformation.
In opening the discussion on requisite activity in an organizational context, we have launched both temporality and distributive systems and networks have been interpreted broadly as active interrelationships covering more dimensions than the one of electronic data interchange and transactions.

5. Distributed knowledge networks

Here we poses the question if foresight is possible in network organization and if so, how to establish requisite foresight?

Foresight expresses the idea that the future is not chaotic or completely unintelligible. On the contrary, there are good reasons to expect less than chaos and yet to realize – with the gift of hindsight – that the future is different from the present but to a degree that is influenced by the factors applied to understand the present.

Thus, if an organization endeavours to analyze its present in terms that are much broader than the present thus capturing how it is changing, then the capacity for foresight is much greater than the organization with a perception embedded only in the present. This is a conjecture interpreting Ashby's findings across time rather than across different systems.

Any organization taking action on environmental signals within a range of expected and known types of signals proves itself viable. Signal and action variables are selected according to organizational, requisite foresight. Since requisite foresight is a conjecture based on cybernetic systems thinking we should be cautious not to jump to conclusions like suggesting that the organization could be correct in anticipating an outcome ensuring the organization's continuous viability.

Requisite foresight also derives from the *time lag* between signal and response, which always characterizes an organization in contrast to biological organisms that may react on instinct or on habits that in both cases exclude deliberation and selection assessment just like Ashby pointed out (see above). Requisite foresight stipulates the non-automatic response to a non-trivial signal. Positively stated, requisite foresight is an organizational and not an individual (organism) construct.

In the network organization we find a variety of intermediate organization constructs that jeopardize the received wisdom of requisite *variety* as known in classic organization theory relying on Ashby, Galbraith, and others.

Classic organization theory establishes requisite variety at the level of organizational routines and discusses at which level of organizational processes to identify the proper routines. The Weberian bureaucracy stood by the rules at task level and organizational structures of authority to cope with deviations (or deviant cases) moving responsibility to the top of the organization. A requisite foresight therefore only applied to *conventional* input given the hierarchical reaction of the organization. Requisite foresight became identical to inscribed rules and routines of the bureaucracy turning cause and effect upside down: The bureaucracy defined the environment in terms of the input that it could process. Anything beside was 'not their responsibility' to name the response. Insufficient attention to changes in the environment took down one bureaucracy after another whatever field we observe.

In the human relations school of thinking the same distinction is present though with the difference that human relations delegate authority to lower levels of employees reflecting training and skills and stimulating commitment, which makes the input filter less defensive than the bureaucratic one.

In the network organization the parameters are less routine and more like learning, less structured, more intermediate roles associated with intermittent structures like teams, ad hoc groups or projects, and alliances within and between organizations prevail (Miles and Snow, 1986).

In the cycle model of organization we identified innovation as a business prerequisite taking its toll on managerial capacity. We did not demonstrate the cycle nature of knowledge. Several major contributions to knowledge management have taken a classic life cycle point of view (Nissen 2002): 'Create/capture – organize – formalize – distribute – apply – evolve' are the phases that most often are identified in the literature. In regard to our model of organization, knowledge management becomes yet another process cycle if abstracted like this. But so formulated, knowledge seems taken out of context, which hinders the model to relate to *requisite foresight*.

Only if we stay within the network model can we associate knowledge with foresight because foresight reflects upon the nature and development of the *interdependencies* that are characteristic of the organization activities. Just like Ashby, we would stress the wider scope than the one of an internal organizational process of knowledge storing and retrieval. In the classic life cycle model of knowledge there is no explication of how and why knowledge might become obsolete. It deteriorates as an ageing organism (in an overly biological model). The impact of the environmental interdependency is disregarded.

The wider scope is brought into consideration by the activities that are interrelating cycles. Some of those are transactional whereas others are influence patterns concerning strategic marketing priorities and yet others are innovation bound, all subject to the organization in question (Pedersen, 1996). Specifically, how we should establish cycles for a corporation may be seen in embryo in business process reengineering projects and in more recent follow-up knowledge management process engineering projects (see also Nissen 1999).

From interdependencies we derive networks and from knowledgeable activities we derive foresight. Combining the two makes for *requisite foresight*. Thus we conjecture that it is reflexive management of networks that ensures distributed knowledge cycles inform activities. *Foresight* follows from access to and activities in all channels (cycles) of potential impact upon the flexibility, dispositions, allocations and strategies conducted by the corporation. And that it is *requisite* follows from the degree to which the network is inclusive in regard to erratic changes, which could impact the corporation's capacity to respond.

But how does network organization bring about requisite foresight?

We will not attempt an extensive answer to this question. The idea of requisite foresight being born in working on distributed information systems, it is reasonable to analyse this kind of system to indicate the relevance to the network organization.

6. Requisite Foresight in e-business – a case

In the section above we indicated the relevance of the analysis for distributed information systems. We may refocus a little to get the question right: Can *electronic business* shift focus from *requisite data exchange* to *requisite foresight*?

Data processing has been preoccupied with changing ledgers and inventory lists into databases and with integration across divisions for corporate consolidation to serve corporate management needs at board and division levels. This is the objective of management information systems (Alter, 2002).

The e-business initiatives started out capturing and using data at the source, i.e. at the conduct of transactions and exchange of products, services, and payments. The EDI based message interchange ensured better quality data and less tampering with the same data as they were encapsulated into standard messages that could be machine-read without human intervention.

Today we are in e-business to capture the data we would like to have *before* transaction and exchange reflecting the general model of information use (Choo, 1998). Thus we are driven by knowledge (Richardson, 1972) and secondly by incentives (Porter, 2001) when we exploits communication capabilities of e-business networks and exchanges (Pedersen et al., 2002).

We would like to have data that influence *if* we want to transact and *how* we want to exchange. This pattern reiterates itself in present days exchanges that offer platforms for purchasing (so-called) indirect products and services. A study of exchange development indicates that success follows the distributed knowledge path. Private exchanges succeed in attracting liquidity (frequent transactions with select partners) whereas third party platforms that pursue competitive price purchasing have had much less success. Once more knowledge exchange takes precedence over incentives (price competition) (Pedersen et al., 2002). Instead of marginal price advantages, we observe enhancement of working capital efficiency taking the whole business process into consideration.

Where knowledge exchange is facilitated as the prime strategic target, advantages flow to all involved. Let us take a look at the *case* of IBM's procurement strategy (Carbone, 1999). After IBM had realized that more than 50% of its overall value-added took place at IBM's suppliers, IBM decided to make the suppliers partners in development, thus adopting a *technology procurement* strategy, which means that IBM induce and collaborate with selected suppliers in partnerships for technological developments to meet new (demanding) specifications in the future. Proactive procurement only materializes if the buyer makes credible commitments. IBM does so by taking hand of the single supplier and promising future market opportunities reflecting a degree of loyalty. The suppliers launch multi-annual technology development schemes in agreement with IBM. The degree of *foresight* has become essential to the relationships not only in technology procurement but also in the later supply chain management where IBM market prognoses are transmitted regularly to the suppliers. Foresight cuts suppliers' capital costs up-stream and distributors inventories (reduce capital requirements) and stock will turn over more times, which increases profitability, thus all partners may benefit from a more efficient use of working capital.

As this case indicates, networks of firms are not created by hazard but according to distributed knowledge, which means that with those having complementary knowledge it may be worthwhile to exchange specific knowledge (Pedersen, 1999).

Concluding this section, we conjecture distributed knowledge in a network allows capital efficiency to take precedence over short-term price competition. Furthermore, distributed knowledge is embedded in all types of networks representing various types of knowledge and opportunities to exploit that knowledge, which the recent development in digital (electronic) exchanges seems to witness. Disregarding the knowledge factor is bound to jeopardize a competitive if not strategic position in the network.

E-business thus promises to expand the advantages of distributed knowledge networks in every aspect of conducting business. Requisite foresight does not develop automatically. Knowledge intensive networks of business can be supported by a variety of organizational and information systems initiatives that promote requisite foresight for all partners.

7. Requisite foresight: Distributed knowledge in e-business networks

We have argued that distributed knowledge and e-business seems mutually reinforcing in networks.

We will now present the last of our questions: How do we take foresight into a productive partnership with distributed knowledge?

It has been suggested that ubiquitous computing in the business world will make e-business the normal way of doing business to an increasing degree. To achieve foresight requires using information systems, properly.

Requisite foresight does not refer to a particular kind of information. The information acquisition is particular as well as the model processing the information. Thus we adopt the view that data per se does not provide foresight. Information per se does not provide foresight. Specific information acquisition and models for processing provide opportunities to generate requisite foresight (e.g. Choudhury and Sampler, 1997). Requisite foresight implies that an organization manages conditions designed to acquire information according to explicit hypotheses about the environment and how it impacts the organization and its future conditions of existence. Relevance of information to the company is proven in selecting proper conditions for exploitation of information. To these conditions networks are well suited. A requisite foresight therefore refers to that network, which holds the distributed knowledge that is complementary to any other in the network (Pedersen and Larsen, 2001). The mutual benefits from collaboration and co-ordination in the network reside in the knowledge driven structure of information interchange and transactional information. Distributed knowledge follows as no one in the network has an a priori centralized position.

We have characterised the network as the incumbents' competence to take advantage of information acquired externally and internally from a distributed rather than from a hierarchical unified organization. But how can we know that it is requisite and not generating information overload?

To take advantage of the information requires a model to process the information. If this model is tuned towards change of strategies, routines and organizational structures we will consider this an instance of requisite foresight; just as double-loop learning takes both objectives and strategies into consideration in mutual corroboration (Argyris and Schön, 1978). It is not achieved automatically but the conditions that are required to approach foresight is *already* present in the distributed knowledge network where the prerequisite knowledge to engage in committed development of new technologies, services or products become explicit in cross organizational activities.

From the very conception of network interrelationships those activities that form the requisite information creation merge with collateral information into a synthesis of knowledge; thus what is acquired is refined and resubmitted to extract yet more dis-

tributed collateral information, at any moment to form a knowledge compound. An example of this is the electronic patient record that accumulates each and every diagnosis and treatment of a patient wherever the health provision may derive from (Pedersen and Larsen 2001).
This knowledge enters into strategy and activities to form requisite foresight, of course without guarantee that any kind of change in the network will be grasped and interpreted timely and correctly.
Such a mechanistic prediction cannot be substantiated in this framework.

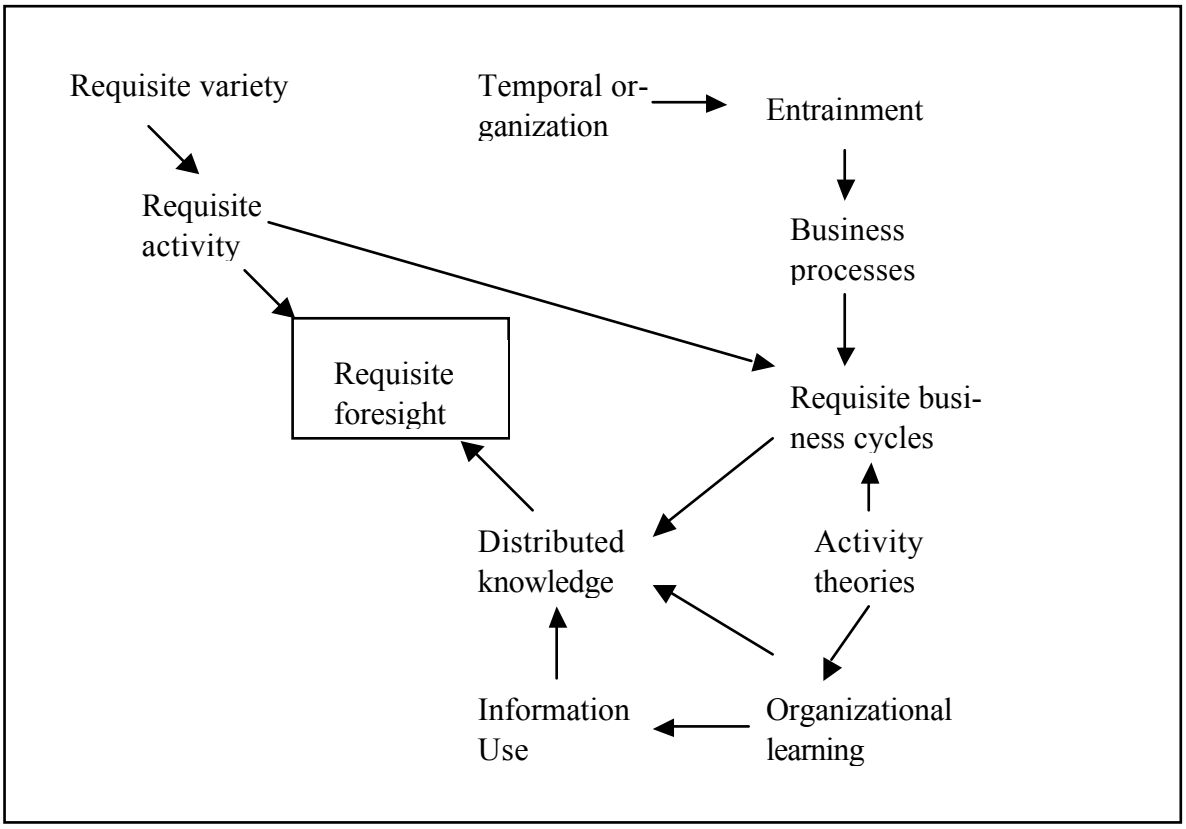

Figure 1. Conceptual model of requisite foresight.

8. Requisite variety, activity and foresight – ex ante a conclusion

In the classic treaty on cybernetics, i.e. the science of control and communication launched by Norbert Wiener, it was recognised that systems interaction could not take place unless certain prerequisites were fulfilled. Cybernetics is a science on "behaving" or on systems properties and performance from a functional and behaviouristic perspective. The approach has generated a wealth of inspirations to a range of disciplines, like operations analysis, planning, management, and organization. One of those inspirations staying on in organizational studies ever since has been the idea of requisite variety. For a system to cope in a complex setting it is required to master signals from its environment before the environment turns against the organization imposing claims it cannot handle.

The first premise of a knowledgeable organization is the observation that there is no *a priori* environment to any organization. How to establish one should be recognized as the first instance of intended organizational development since environments emerge from boundary spanning activities designed to capture, develop and control 'an environment'. Instead of looking for a 'better' way to conceive of the environment or for boundaries of a business we have adopted the temporal view of organization, which excludes a homeostatic and consensual organization. From the simple business process model of 'procure and provide' we suggested a cycle model of organization evolving objectives and inter-organizational coherence.

The organization model is temporal in the sense of moving through time while at the same time instigating a time for procurement and a time for which to furnish or provide output to customers. The temporal organization processes are irreversible.

In a temporal multi-cycle organization model we look for how managers cope. The fights over strategy and resources fought within the board itself are possibly due to an insufficient account of the 'significant' environment that they need to explicate if they strive for requisite foresight; and if unsuccessful that may be due to sense making prerequisites (Weick, 1995). So this is not a model of harmony. Contrary, it is evident that the model reflects the conflict prone relationship to both suppliers and customers, which make their specific knowledge valuable from the point of view of foresight.

The knowledge management aspect of the multi-cycle view of economic organization is captured in distributed knowledge management. Distributed knowledge management contrasts conventional knowledge management findings that in an innovative economy holding on to your core competencies gives little sense when your product is sincerely dependent upon a multitude of collaborating businesses as exemplified in the case of IBM.

Innovation within an evolving division of labour are a driving force towards a knowledge based economy and even of an e-economy where the Internet is the backbone of a network economy. Fuelling the opportunities to conduct economic exchange on the Internet has at the same time catalyzed the fact that network based collaboration outperforms all other known means of communication for innovative behaviour.

Challenges to organization theory may be less in terms of the cycle approach and more in terms of new 'organizational entities': Organizational embedded distributed knowledge networks enabling knowledge support across collaborative communities and many more intelligent software agents paying visits across knowledge networks, yet being responsive to their 'masters' even if not always aware of that. Foresight enters into our technological tools enhancing their business value: Visions of a future with yesterday's technology showing that organizational preconditions are no less strong than the technologies.

9. Conclusion

In a context of ubiquitous uncertainty economic organizations have sought ways to gain certainty, contemplating and conducting curtailment of competitive powers by strategic positioning, erecting barriers to entry, tacit agreements, conspiracies, and explicit or tacit collaboration with more or less credible commitments; all defensive measures that are bound to fail in a fast changing globalizing world.

While to tame some causes of uncertainty is a recommendable way of thinking it is less in violation of (economic) competition laws to turn the issue around and start looking for how to understand that part of the environment, which is expected to be most influential on change requirements leveraged against the firm. This is what requisite foresight is all about. In this sense, *requisite foresight* has been on the agenda on corporate level ever since concepts surfaced on IT-based supply chain management, customer relations management, e-markets and exchanges; all concepts of proactive business operations. Briefly, we may conclude that the digital devices and tools have helped (re-) launching the development and reassessment of distributed knowledge in network organization.

References

Alter, Steven (2002 *Information Systems: Foundation of E-Business*, 4th ed., Upper Saddle River, NJ; Prentice-Hall.

Alstyne, M. van. (1997) The State of Network Organisation: A Survey in Three Frameworks. *Journal of Organisational Computing and Electronic Commerce.* 7 (2&3), 83-151.

Ancona, D,G and Chong, C.-L. (1996) Entrainment: Pace, cycle, and rhythm in organizational behavior. *Research in Organizational Behavior*, 18: 251-84.

Ancona, D,G., G.A. Okhuysen, L.A. Perlow (2001a) Taking time to integrate temporal research. *Academy of Management Review*, 26 (4) 512-29.

Ancona, D,G., Goodman, P.S. , Lawrence, B.S., Tushman, M.L. (2001) Time: A new research lens. *Academy of Management Review*, 26 (4) 645-63.

Argyris, C. and Schön, D. (1978) *Organizational Learning: A Theory of Action Perspective*. Reading, Mass. Addison-Wesley.

Ashby, W. Ross (1964) An Introduction to Cybernetics. London. Methuen: University Paperbacks (First published 1956).

Carbone, J. (1999) Reinventing Purchasing. *Purchasing*, September 16.

Castells, M. (2001*) The Internet Galaxy*. Oxford: Oxford U.P.

Choudhury, V. and Sampler, J. L., (1997) Information Specificity and Environmental Scanning: An Economic Perspective. *MIS Quarterly,* March 21(1),25-53.

Choo, Chun Wei (1998) *The Knowing Organization.* New York: Oxford University Press.

Dixit, A.K. and Pindyck, R. S. (1995) The Options Approach to Capital Investments. *Harvard Business Review,* May-June, 105-115.

Engeström, Y. (1987) *Learning by Expanding: An activity-theoretical approach to developmental research.* Helsinki: Orienta-Konsultit.

Fulk, J. and DeSanctis, G. (1995) Electronic Communication and Changing Organizational Forms. *Organization Science*, 6(4) July-August, 337-348.

Galbraith, J.R. (1973) *Designing Complex Organizations.* Reading, Mass.: Addison-Wesley.

Ghoshal, S. and Bartlett, C.A. (1990) The Multinational Corporation as an Interorganizational Network. *Academy of Management Review*, 15 1990, 603-625.

Granstrand, O., Patel, P., Pavitt, K. (1997) Multi-technology corporations: Why they have "distributed" rather than "distinctive" core competencies. *California Management Review*, 39 (4), 8-25. Summer.

Hayek, F.A. (1937) Economics and Knowledge. *Economica*, N.S. 4, 33-54.

Hayek, F.A. (1945) The use of knowledge in society. *American Economic Review*, 35, 519-30.

Kavanagh, Donncha and Araujo, Louis (1995) Cronigami: Folding and unfolding time. *Accounting., Management and Information Technology,* 2, 103-21.

Keynes, J. M. (1921) *A Treatise on Probability.* London: Macmillan. (1973 edition)

Loasby, B.J. (1999) *Knowledge, Institutions and Evolution in Economics.* Routledge, London.

Lucas, H.C. and Baroudi, J. (1994) The Role of Information Technology in Organization Design. *Journal of Management Information Systems*, 10(4) 1994. 9-23.

McGrath, J.E. and Rotchford, N.L. (1983) Time and Behavior in Organizations. *Research in Organizational Behavior*, 5. 57-101.

Metcalfe, S. and Miles, I. (2000) *Innovation systems in the service economy. Measurement and case study analysis.* Dordrecht: Kluwer Academic Publishers.

Miles, R.E. and Snow, C.C. (1986) Network Organizations: New Concepts for New Forms. *California Management Review,* 28, 62-73.

Nissen, Mark E. (1999) Knowledge-Based Knowledge Management in the Re-engineering Domain. *Decision Support Systems,* 27, 47-65.

Nissen, Mark E. (2002) An Extended Model of Knowledge-Flow Dynamics. *Communications of the AIS*, 8, 251-266.

Pedersen, M. Kühn (1992) Information Technology as a Strategic Factor in Trans-nationalization. in J.J.J.van Dijck & A.A.L.G.Wentink (eds.): *Transnational Business in Europe. Economic and Social Perspectives.* Tilburg University. pp. 120-50.

Pedersen, M. Kühn (1996) *A Theory of Information(s). The Business Cycle Model.* Copenhagen: Samfundslitteratur.

Pedersen, M. Kühn (1999). Professional business service innovation: A distributed knowledge approach. *CISTEMA Conference*, Mobilizing Knowledge in Technology Management. October 24-27, 1999. Copenhagen, 2 vols. 478-501.

Pedersen, M. Kühn and Larsen, M.H. (2001). Distributed Knowledge Management Based on Product State Models – The Case of Decision Support in Health Care Administration. *Decision Support Systems*, 31 (1), May 139-158.

Pedersen, M. Kühn and Larsen, M.H. and Berntsen, C. (2002) Contested Hegemony: The Demise of Industry Economics in Information Systems Analyses*? 25 IRIS Conference*, Kulhuse, August 10-13, 2002.

Porter, M.E.(1985) *Competitive Advantage*. N.Y. Free Press.

Porter, M.E. (2001) Strategy and the Internet. *Harvard Business Review*, March.

Prahalad, C.K. and Hamel, G. (1990) The Core Competence of the Corporation. *Harvard Business Review*, May- June, 79-91.

Richardson, G.B. (1972) The organisation of industry. *Economic Journal*, 82, 883-96.

Shannon, C. & Weaver W. (1959) *Mathematical Theory of Communication.* University of Illinois.

Simon, H. A. (1955) A Behavioral Model of Rational Choice. *Quarterly Journal of Economics,* 69, February.

Simon, H. A. (1957) *Models of Man.* N.Y. Wiley & Co.

Tsoukas, H. (1996) The firm as a distributed knowledge system: A constructionist approach. *Strategic Management Journal*, 17, Winter, 11-25.

Weick, K.E. (1995) Sensemaking in Organizations. Thousand Oaks, CA: Sage.

Wernerfelt, B. (1984) A Resource-Based View of the Firm. *Strategic Management Journal*, 5, 171-80.

Williamson, Oliver E. (1975) *Markets and Hierarchies: Analysis and Antitrust Implications.* New York: Free Press.

Williamson, Oliver E. (1985) *The Economic Institutions of Capitalism.* New York: Free Press.

Von Bertalanffy, Ludwig (1968) *General Systems Theory*. New York: Braziller and Comp.

Zigurs, I. & Qureshi, S. (2000) The Extended Enterprise. Creating Value from Virtual Spaces. In Dickson, Gary W. & DeSanctis, Gerardine (eds.) *Information Technology and the Future Enterprise.* Upper Saddle River, N.J.: Prentice Hall, Inc.