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## The Emergence of the Interprise

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### Abstract

Industrial competition is advancing from being between individual companies, to being between extended enterprises, in an environment which is agile, constantly changing in unpredictable directions. The reasons for this are several, but they all converge on the same result, that competitive pressures for reduced prices, and better customer-centered quality and functionality, force companies to interact intensively. This development in turn, is having a profound effect on management and structure both within and between companies, because the extended enterprise has evolved into a single system with real-time interactions between companies. The individual enterprise, which is international and interactive in the culture of the internet, has been termed the **Interprise**. This paper reviews these trends and shows emerging models for the new structure.

### Keywords

Agility, extended-enterprise, interprise, globalization, competitiveness, supply-chain, customer-relations

## 1 THE DRIVERS OF CHANGE TO THE INTERPRISE

The industrial competitive environment is changing under the influence of a number of inexorable influences. These include:

*Ubiquitous availability and distribution of information*

A most profound change over the last decade in both working environment and the lifestyle has been the proliferation of communication technology. Not only do more people have radios and television than are literate, but this technology has engulfed much of the planet. The phenomenon of instant news has created unprecedented new challenges. In industry, new designs and production instructions are passed around the planet at the speed of light. For the military, the knowledge that operations are now often carried out in view of the worlds' TV cameras has changed operational planning. For foreign offices in many countries, CNN and Sky have become primary sources of information in emergencies. In many families and schools, children are more familiar with internetworking than are the adult parents and teachers who are nominally more knowledgeable. Encyclopedias and databases are going on-line, often using web technology, at bewildering speed. Information which a few years ago was hard to find has now become rapidly accessible on the internet web using increasingly sophisticated search engines. A few hours after the pictures of Mars became available, they were put on web sites around the world, and within one day over a million 'hits' were made on those sites. Never in human history have we been able to distribute so much information to so many people so directly and rapidly. Almost anyone can make information available, and the user can 'pull' the information he or she wants, without requiring 'push' from the supplier.

*Rapid proliferation of education*

Allied to the expanding use of communication and universal accessibility to information, but not only because of those reasons, is the rapidly increasing number of educated, technologically proficient, people in the world. In many countries which the news media paint as undeveloped, there are technically competent people who can use modern computers and machines to develop and manufacture quality, high-technology, products. Examples are the ability of the Iraqis to produce nuclear weapons more quickly than the West had thought possible, or the ability of the Chinese to manufacture by copying not only diskettes and compact disks, but also Jeeps and other engineered products. The rapid industrial rise of countries like China and India is evidence of the spread of education.

*Accelerating pace of change in technology*

Technological developments beget other technological developments, and the pace of these developments therefore increases exponentially. It took 35 years for 10 million people to be connected to the telephone. For 10 million people to get connected to the world-wide-web took 1.25 years. This exponential change of technology penetrates every activity, from consumer music to industrial production machines, and is clearly visible to everyone.

*Expanding access to new technology*

Not only is new technology developed ever more quickly, but that technology is made available more rapidly around the world. The expanding availability of education and information, together with the exponential development of new technology, lead to reduced unit prices for technological capability, and that technology can be economically accessed by knowledgeable people. The printing industry is an example. A little-qualified person using today's desk-top computerized publishing facility can do specialized customized design and publication work, which in the days of the lead type and big printing presses, would have been quite impossible. The capability of a \$500,000 machine tool of 15 years ago is now available for less than \$50,000; a \$1,000 desktop computer today has more power than a \$100,000 computer 10 short years ago. This decreased cost per unit of activity, augmented by the spread of education and communication, and the opportunities afforded by the globalization of industrial markets, is allowing many energetic people, previously held back by geography and economic barriers, to join the world's entrepreneurs.

*Globalization of markets and business competition*

Accompanying all the changes mentioned before is an opening up of the world to a globalized marketplace. Suppliers and customers can more easily look further afield than before, for business. In one sense, it can be thought that the political actions which reduce barriers and open up the world to commence do no more than follow the lead of technology and especially communication. So long as there is not reversion to systems of extreme isolation and balkanization, which is always an incipient danger, technology does indeed force globalization.

*Changing meanings of words and concepts*

Weizenbaum (1977) wrote 'Tools shape man's imaginative reconstruction of reality'. That has always been so. The creations of the visual and performing arts follow not only from the tools, but also from the concepts of technology. The defining technologies of the 20<sup>th</sup> century were mechanical; everyday conversation, news reports and talk shows use mechanical metaphors, such as to 'push the gas pedal', to 'overhaul', to 'mesh with' and so on. The defining technology of the this decade and the next is communication technology. Management systems of the 20<sup>th</sup> century focussed on making the company seen as a machine, efficient. Management systems of this and the next decade focus on the company as part of a communicating network. The construction of the extended enterprise follows not only from requirements of lowered costs, shorter times and higher quality, but more deeply from the images and concepts which we all absorb unconsciously from the environment, and which are changing from the images of mechanical machines to the images of a globally-connected fluid network of interacting nodes.

## 2 THE INTERPRISE

A company is a legally recognized entity with defined boundaries of responsibility and authority. In that sense each company is indeed an independent entity. Operational terms do not need to be identical with the legal concepts. Companies in the past perceived themselves as stand-alone both in the legal and the operational contexts. A company would make its plans based on orders from customers, data about marketplace developments, and information from suppliers and other sources. Whatever the sources of information, the plans and management decisions were autonomously those made by the company alone, and implementation of those plans made no provision for modification due to real time information from sources external to the company. If such changes were needed, the changes were considered interruptions and required management intervention and decision. In the traditional commercial system companies were operated independently, guided by plans and forecasts which were time-invariant, that is, static.

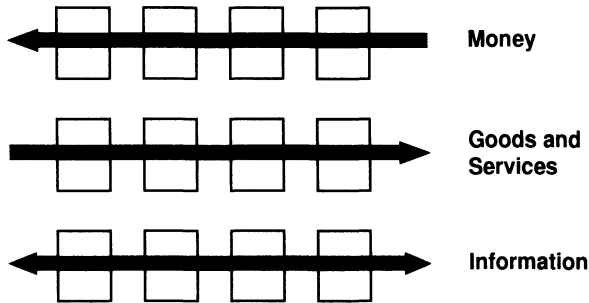
Times have changed. Today companies begin to perceive themselves as part of value-adding chains, operating under conditions where the ability to change is as important, or even more important, than the ability to be unchangingly efficient. Jack Welch, the successful CEO of General Electric, says that when change imposed from outside the company is faster than the ability of the company to change internally, it is doomed. It may be doing its work very efficiently, fast and at good quality and low price, but it is doomed nevertheless.

This change in perceptions, structure and management focus derives from a conjunction of developing concepts of the world as a network, together with very concrete business reasons. Many companies have discovered that a major proportion of their costs derive from suppliers. In many manufacturing companies, when analyzing the costs of shipped product, the fraction of the cost going to suppliers varies from 50 % to 95 %. As these companies have become more efficient and have reduced costs internally, they have found that the major opportunity to reduce cost is in the supply chain. If one holds the supplier at arm's length, and not coordinate work processes between companies, the cost reduction will be a grudging few percent. However, if one coordinates the work processes between companies, so that the customer makes different demands which allow the supplier to save cost, and the supplier does things differently so that the customer can save cost, significant savings are possible. If a supplier makes a change which saves internal cost to Harley-Davidson, the motor-cycle manufacturer, Harley will share half the saving with the supplier, so as to motivate it to generate such savings.

Hence we see that competitive pressures for reduced cost and time, together with the requirement that companies enhance their ability to change under the pressures of unavoidable drivers, have created a new system of commercial enterprises. We have moved from a system of companies managed in isolation and assumed to behave in a static manner, to a system of real-time interactive companies in a dynamic system. If one thinks of interacting companies as a network, we perceive

the emergence of companies interacting in a network, where isolated nodes existed before. This new system is the **extended enterprise**; a collection of interprises which are interactive and international in the culture of the internet. No proactive deliberate decision created this new system; competitive pressures did.

An interprise is best modeled in terms of the flows between the processes which comprise it. Figure 1 shows the three primary flows in the interprise. It shows the flow of money down the system, which is justified by the flow of goods and services up the system, which in turn is enabled by the flow of information both ways in the system. These flows are intimately interconnected. The money flow is induced by the flow of goods and services. The flow of goods and services is induced by the flow of information. These are interrelated and one cannot be modeled separately from the others. Inaccuracies or delays in information flow cause amplified problems in the flow of goods and services, which in turn cause amplified problems in the flow of money (Anderson et al 1997, Lee et al 1997).



**Figure 1** Primary Flows in the Interprise.

### 3 THE TRAFFIC ANALOGY

A system of interacting business processes necessarily becomes dynamic. The word 'dynamic' has a clear technical meaning. It does not simply mean 'energetic'. A dynamic system is one in which accelerations become so important as to change the behavior of the system. An example is a building which normally is subjected to static loads, but when an earthquake strikes is subjected to accelerations. Another example is the flow of electricity. In a direct-current (DC) circuit, the voltage and current do not change with time; in an alternating current (AC) circuit they do vary, and in doing so generate a time lag between them. As a result the mathematical equations which describe the system are quite different, because the system's behavior is quite different.

We all have experience of a system which moves from being arm's length and static, to being interactive and dynamic. Road traffic is such a system, in which we

can consider the car in front to be operating on a piece of road, then passing it to the car behind. The amount of road between the cars is analogous to the inventory placed between the companies, in warehouses or somewhere else inside the logistics system. Consider travel on a road with the traffic spread out very widely. On such a road the driver of a car need pay no attention to the brake lights of the car ahead, and need not look in the mirror at the car behind.

- No real time information from the car behind or ahead is needed in order to drive.
- Each driver can autonomously choose any speed, without being influenced by the cars ahead or behind, until all the road (which represents material) is used up between the cars.
- On the open road the rates of acceleration and deceleration have no importance; the quality of the braking system is not important.

Now consider driving in an interactive traffic system, a crowded freeway such as experienced by everyone in the modern world. In such a situation a driver must necessarily pay careful attention to the brake lights of the car ahead, and to the car behind.

- Exchange of real-time information between cars becomes essential.
- Whereas on an open road a driver can make an autonomous decision as to the speed to drive, in the crowded freeway no single driver can make that decision.
- The speed of traffic becomes a system characteristic, defined by the complex dynamic interactions between the cars.
- In crowded traffic, the ability to accelerate or decelerate are very important to avoid accidents and to succeed.

The real-time interaction of the cars on the crowded road creates a single system, and in this system dynamic effects, and the ability to accelerate and decelerate, become primary survival and success characteristics. This is in contrast to the open road where each car is managed independently in a static environment where acceleration and deceleration ability are unimportant. The commercial industrial world has evolved from being a collection of independent business units in static behavior, to being a single system operating in a dynamic mode. The behavior of a dynamic system is not an extrapolation of a static system; it is a fundamentally different system. Today's industrial and commercial world, being interactive and dynamic, behaves fundamentally differently than the past arm's length static system and requires fundamentally different management approaches.

#### 4 THE LINK IN THE CHAIN – THE INTERPRISE

In the arm’s length static world one would design the structure of a company bearing in mind the products, information and materials it would output and input, but that structure would not be influenced by the procedures and processes within one’s customers or suppliers. In the interactive, dynamic world the perspective is different. The company’s sees its structure and destiny as being a link in the value-adding chain, in other words, an interprise.

This perspective changes many requirements in the structure, leadership and operation of a company. It changes the focus of management attention from products to processes. In the dynamic world of rapid change where one is in an interactive relationship with suppliers and customers, the focus of competitiveness and management becomes core **process** capability, rather than the **products** produced, which may change rapidly.

Figure 2 shows a standard model of a process in general, using the IDEF format.

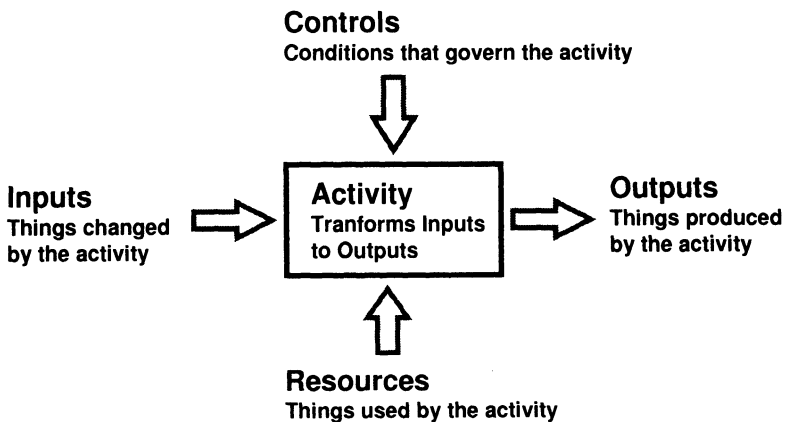


Figure 2 Anatomy of a process.

Figure 3 uses such a process description for an agile business unit. This shows the major items for input, output, internal structure and resource needed. These four items are the four major attributes of an agile organization, or dynamic interprise:



**Figure 3** An agile business unit as a process.

*OUTPUT – Enriching customers with total, individualized, solution-products*

In an agile world, customers pay either a fee for skills, materials, and a modest profit for products, or they pay a percentage of the perceived value for solutions. Companies adopt a value-based strategy to configure products and services into individualized and total solutions that provide their customers with perceived enrichment, for which they are therefore willing to pay.

*INPUT – Collaborating suppliers in a virtual organization*

In an agile organization, cooperation enhances competitive capability. Companies use the virtual company model inside and outside to share responsibility and enhance cooperation opportunistically across organizational lines.

*INTERNAL STRUCTURE – Entrepreneurial adaptive organization*

Agile competition is based on the ability to thrive on change and uncertainty. Companies use an entrepreneurial organizational strategy, which can respond to changing conditions more quickly than a hierarchic structure.

*PRIMARY RESOURCE – Knowledge-driven enterprise*

In an agile environment, organizations sell skills, knowledge, and information over time. Companies make investments to increase the strategic impact on their bottom line of the knowledge and innovation generated by their people and information systems.

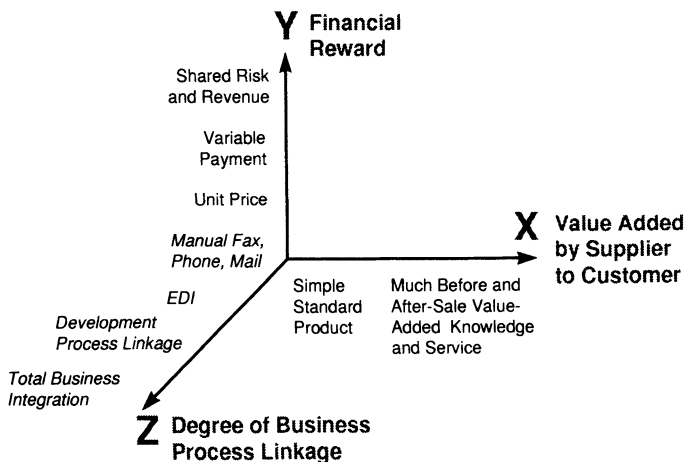
Rather than considering the value-adding chain as following from the characteristics of the company, the structure and management of an agile company follow from the characteristics of its value-adding chain. The term ‘value-adding chain’ usually implies companies working at arm’s length, with the output of one being the input of the other. This has now become one coordinated system, an interactive network rather than a chain.



This understanding opens up another central subject, which will be only briefly mentioned here. Competition is increasingly between extended enterprises rather than between individual enterprises. Companies are starting to proactively manage portfolios of customers, and to rationally choose which value-adding chains they join. Among the reasons for this are to hedge against the downs and ups and vagaries of being part of a single product-centered industry, for instance the automobile industry sector, or computer industry. This central and considerable subject will not be developed further here.

## 5 THE INTERPRISE RELATIONSHIP MODEL

Attention will now be focused on the relationship between two business units, which are links in the demand chain. This interprise relationship model shown in Figure 4 (Preiss 1997, Goldman, Nagel & Preiss 1995, Preiss, Nagel & Goldman 1996) is based upon the primary variables in a relationship between a pair of companies. When modeling a system, it is desirable that the variables for the model cover the situation to be modeled, are independent, and are a minimal set. The three variables of this model are such a set.



**Figure 4** The Interprise relationship model.

The X axis represents the added value conferred on a customer by a supplier. This can be any combination of hardware, service, or knowledge over the entire lifespan of a project or product. These can include special design, customized delivery, upgrades, maintenance, decommissioning, and recycling.

The Y axis represents the reward or payment made by the customer, from fixed price through variable payments to shared risk and reward.

The Z axis represents the degree of business linkage between companies, starting with disconnected processes, such as mail, fax, and telephone, through electronic data interchange, to a complete integration of operations.

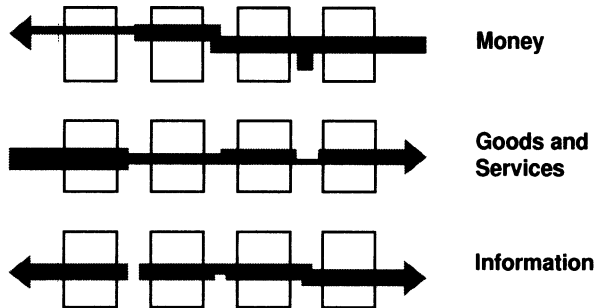
In short,

- The horizontal, X axis represents what the **supplier** gives the **customer**.
- The vertical, Y axis represents what the **customer** gives the **supplier**.
- The third, Z axis represents how they **work together**.

These three factors define a space within which a relationship between two companies is located. Figure 1 showed the same values using parallel arrows, and is a generalization of this model to the extended enterprise.

Mass production and product-focused trade, where a predefined product is exchanged for a price, and where cost is the only decision variable, is at the origin of the axes in Figure 4. As real time interactions between companies increase in intensity, the relationship moves out into the volume of the three-space.

It is interesting to note how efforts made in any one of the three axes must be balanced by efforts in the other two. Movement has to be coordinated along all three axes in order to achieve a higher value in one of them. Using the three dimensional space of Figure 4 allows one to discern an optimal region for an inter-company relationship, in the region of the 45 degree diagonal in space. This can be understood as follows. Imagine a relationship being located at a low value of Y and a high value of X. Here a supplier is required to provide much variable support to the customer while paid on the basis of unit price of product. Such a relationship creates an intolerable strain on the supplier and inevitable leads to friction and possible divorce. It is an untenable region of that diagram. Now imagine a relationship at a high value of Y and a low value of X. Here the customer takes standard product but pays based on shared risk and reward. This creates an intolerable strain on the customer as it is detrimental to his success. Similarly, viewing the Z axis, the effort and expense of integrating business processes can be justified only for high values of X, where the supplier constantly provides much value-adding service and information; for commodity price-centered trade at low values of X, business process integration is unnecessary and wasteful. It is therefore desirable to operate in the region of the 3D space diagonal.



**Figure 5** Real flows in the interprise

The biggest barrier to the emergence of the interprise today is alignment between the three major flows of Figure 1. Figure 5 is as Figure 1, but makes the point that the flows are choked, discontinuous and misaligned. Overcoming these barriers to the flows provides the opportunities for research and for consulting.

## 6 CONCLUSIONS

Global competition and the pressures to lower costs while increasing the quality and variety of products and services is leading many companies to seek improvements beyond their own borders, by coordinating entire extended enterprises as interacting interprises of customers and suppliers. This not only reduces cost and time while increasing quality, but enables the interprise to adapt and reconfigure to take advantage of rapid change and sudden opportunities.

The emergence of the integrated system of interprises in place of a collection of arm's length enterprises is the emergence of a system where no system existed before. This creates a new opportunity for imaginative corporate management, for research and for consulting.

Efficient coordination with customers, customers' customers, suppliers, suppliers' suppliers and beyond, requires alignment of business strategies, of the way people work and the relations between them, and of technology processes. It also usually leads to new and profitable strategic directions.

As companies move from being stand-alone entities which pass product one to another, to being links in an interactive, adaptive, extended enterprise which deals successfully with rapid change, an unprecedented level of integration of people, business processes and technology is required. The fact that the competitive environment is leading companies to becoming interprises, is manifested in many operational details which sometimes hide the overall trend. Projects such as integration of the supply chain, just-in-time material supply, theory of constraint

analysis of bottlenecks, total quality management, different cost accounting and prioritization methods, becoming part of the customer's business or lifestyle processes, enterprise integration, and many more of which we have all heard, are operational details. They point to the change coming over the competitive environment, from being a collection of loosely coupled enterprises to being tightly coordinated interprises. This understanding of the overall trend and the change in the system, enables us to better plan and prioritize the operational details of companies.

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## 8 BIOGRAPHY

Professor Kenneth Preiss is an authority on international industrial competitiveness. Over a 35-year career, he has led projects from enterprise strategy and transformation to technical development. He is an honorary member of the American Society for Mechanical Engineers, holds the Sir Leon Bagrit chair in Computer-Aided Design at Ben Gurion University in Beer Sheba, Israel, and is a Senior Fellow at the Agility Forum, as well as Editor-in-Chief of the John Wiley journal, **Agility & Global Competition**.

In 1991 Dr. Preiss was selected by the Iacocca Institute of Lehigh University to analyze the U.S. role in the changing structure of worldwide industry. He was one of the facilitators and a co-editor with Steven Goldman and Roger Nagel of the resulting report **21st Century Manufacturing Enterprise Study: An Industry Led View** which had been commissioned by the U.S. Congress through the Department of Defense. This widely-accepted report identified the emergence of the new system-wide competitive environment which has been called agility.

A dynamic speaker and accomplished writer, his extensive list of published work includes close to 200 original research papers and reports. He co-authored both **Agile Competitors and Virtual Organizations: Strategies for Enriching The Customer**, and **Cooperate to Compete: Building Agile Business Relationships** with Steven Goldman and Roger Nagel. He also was chief editor of the **Handbook for Virtual Organization: Tools for Management of Quality, Intellectual Property and Risk & Revenue Sharing**, 1996.