

The Integrative Facilities of Organizational Systems Applied to the Core Corporation

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The geometric explosion of Internet activity has spawned a new era in which old paradigms collapse regularly. The electronic redefinition of the value chain challenges the transaction cost economist's models as transaction costs approach zero. As the pace of change increases, the demand for response from the business community becomes more intense. Information technology fosters the survival of small, high quality firms by enabling communication and coordination among individual entities previously only possible through the centralized management of a bureaucracy. The integrative forces of technology will allow for a new breed of firm that enjoys the flexibility of a small firm while performing large tasks through cooperation with other similarly focused firms. The flourishing growth of Internet-based firms should provide proof of principal on the survivability of organizations in one of the most volatile market environments yet.

In volatile, highly technical fields such as the computer industry, smaller firms have demonstrated the ability to out-maneuver their larger competitors (witness the gains of Apple and Intel at the expense of IBM and other mainframe manufacturers). Accelerated by the electronic commerce phenomenon, small companies (hardware, software or services) often bring new products to market more quickly, respond to emerging opportunities in the market more swiftly, and (perhaps emboldened by a survival instinct) seem more willing to take risks required for order-of-magnitude-level innovation.

In *Big Blues: The Unmaking of IBM*, Paul Carroll (1993) offered the prototypical example of this scenario, as he described the birth of Microsoft at the expense of IBM. Carroll suggested that while mainframe-minded IBM executives failed to foresee a market for a personal computer, Bill Gates practically had success thrust upon him. Large firms are often accused—and seldom acquitted—of unduly influencing competition in an industry due to the leverage available through size alone. (Ironically, Microsoft has now come full circle in this respect.) When a small firm encounters and prevails against an IBM-sized competitor, the victory helps preserve the spirit of competition necessary in a market economy.

Though the path to success for high-technology small firms may seem daunting, the maintenance of success once achieved proves equally challenging. The dilemma addressed herein lies in the challenges associated with the maintenance of success. Danny Miller (1990) summarized the character of this dilemma in *The Icarus Paradox*. Icarus of Greek mythology flew so high and so close to the sun that his wings melted, plunging him into the sea. The strength and power of his wings eventually led to his demise. The nature of this paradox, according to Miller, plays out with equal tragedy in corporate affairs. Just as Icarus's greatest strength led to his destruction, so, too, do many companies come to destruction.

The challenge, then, is to evolve an organizational response for highly technical industries that would provide for the benefits of the small, flexible firm, as well as the stability and staying power typically associated with the large, well-resourced firm. At least three paths lay open to achieving this mission: make a large firm more flexible; make a large firm seem small through

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decentralization; or make a small, flexible firm more economically powerful in order that it might wield the comparable market power of its larger cousins. The first path, making a large firm more flexible, usually involves expansion either through diversification or dispersion. Diversification buffers the organization against the whimsical nature of customer preferences and the uncertainties associated with the development of new technologies. Dispersion develops an increased access to economies of scale. This option has merit, but does not address the requirement for achieving flexibility.

The second path, making a large firm seem small through decentralization, has charm for the buying public. Characteristics of this approach include increasing the decision latitude of lower level line managers, conversion of units to profit centers, forsaking mass production for flexible manufacturing. This is along the lines of mass customization described by Joseph Pine, II (1993) in *Mass Customization: The New Frontier in Business Competition*. The archetype for this customer-centered model may be found in Davidow and Malone's (1992) description of the virtual corporation whose willingness—and ability—to accommodate clients' special interests offsets the price advantages enjoyed by their larger, less customer-sensitive competitors. In spite of its appeal in being able to offer widgets in a variety of colors, the virtual corporation still suffers from the weight of onerous bureaucracy typical of large companies when asked to respond to more dramatic shifts in the market environment.

The first path tended toward making firms larger; the second path tended toward making organizational hierarchies flatter. The third reorganization possibility, making a small, flexible firm more economically powerful in order that it might wield more substantial market power, supports a small organization. It is this option that provides the environment for the greatest impact of well-designed organizational systems. The organization model in this class derives more from circumscription than contraction, and will be referred to hereafter as the *Core Corporation*.

Core Corporation Model Overview

The basis of the core corporation evolves from a process of eliminating all but a single line of business, or building a company from (and staying with) a single line of business. The character of this single line of business will not be defined by product market definition as by a particular technology, such as optical data devices, aerospace navigational equipment, or perhaps high volume saline filtration systems. The core corporation exists, then, as a high-tech oriented job shop: able to develop and produce multiple products, but all centered on a single, often proprietary technology. The core corporation provides the capability to enjoy the benefits of size without the inherent risks.

Merely reducing the size of the corporation, however, will not result in achieving the desired operating benefits. For corporations to thrive, they must address their organizational structure and orientation. This holds true both for the small firm striving to compete with the industry giants, and the large firm seeking to avoid being forced into a defensive requirement to curtail operations. The opportunities and risks associated with this dilemma are acute for those companies operating in a highly technical industry.

Current business patterns of the largest tier of companies ultimately evolved from principles set down over two centuries ago by Adam Smith (1986) in his epic volume, *The Wealth of Nations*. The concepts Smith preached encouraged the birth and growth of the Industrial Revolution. During the apex of this revolution, many extremely large firms grew in an atmosphere of almost limitless demand for their products. In reviewing the history of that period, not many historians refer to international competition, competition through innovation, or the necessity to respond to rapidly changing technology. Firms seemed to have found plentiful markets for their own wares as well as the competition. Product life cycles were sufficiently long to allow for sustained profits on the cost of manufacturing. Nations certainly practiced international trade, but not with the breadth of goods and services realized by current standards. By current

standards, especially in the highly technical industries such as computers and aerospace, the Adam Smith paradigm has become obsolete. In the 1990's, products became superseded within months; consumers became more finicky and more fickle. In a collection dedicated to the idea of business change, Champy and Nohria (1996) explained,

Change today is faster, more erratic, and more elemental than ever before. A collision of technological, competitive, and cultural pressures is forming the vortex of what we have begun to call the 'information age.' (p. xiii)

The market for a product or service may be anywhere in the world, but so may be the competition. In his last book, *The New Economy*, W. Edwards Deming (1993) stated, "The market is the world. Today, the market for almost any product may be anywhere in this world." With the ability to keep current on news anywhere through television, facsimile machines, world-wide networks, satellite communication and other evolving technologies such as digital communication, corporations must adopt a willingness to examine the credibility of their organization structure and orientation.

This phenomenon of a world market place demands that industry adjust their paradigm for survival. As the flow of information worldwide continues to improve, companies realize ever-increasing battles with market share—often from small companies that otherwise might have remained unknown. The common denominator to many of the recent success stories in business includes a commitment to improving the efficiency of organizational systems through informed application of information technology. As Galbraith (1993) states in *Organizing for the Future*:

Most organizational designs and management practices were not created with the current rate of change in mind. They were created to work well in a more stable, predictable world (p. 1).

As the core corporation applies information technology to improve its business processes, it will develop an organization flexible enough to respond to the rapidly changing environment of the world market.

Organizational Characteristics

The core corporation model is based on an organizational structure that challenges the basic premise of bureaucracy. That is, the individual is more important than the office he or she holds. So in the model, when an organization experiences turnover, its structure must change. The model introduces the concept of a Broker and Administrator function and how they relate to a community of core corporations working together to conduct large-scale business. A discussion of each of these roles follows.

The Role of the Broker

The Broker fulfills many of the responsibilities delegated to the executives and senior management in a bureaucracy. Unlike the bureaucracy, though, the Broker is not an executive of any of the firms for which he/she exercises these responsibilities. In the traditional Mintzberg model, management roles derive from the formal authority and status vested in individuals via a board of directors and/or articles of incorporation. Here, the Broker operates according to a formal bestowal of authority, yet is not a member of any of the firms served.

The status of the Broker is similar to the relationship between the European Union (EU) and the autonomous countries that comprise that union. The EU is not a state. The EU does not qualify as a supreme public power within a sovereign political entity. Even though the model entrusts the Broker with responsibilities that may parallel a typical bureaucratic executive or managerial office, the non-bureaucratic characteristics of the Broker abate the similarities. Indeed, there exists no institution analogous to the Broker in either the traditional executive or managerial category.

Moreover, the Broker function serves at the discretion of the member core corporations in that

community that jointly contribute to the funding of the Broker function and agree to abide by the Broker's decisions. Members also share the joint responsibility of replacing the Broker if/when needed. Given that the Broker is not an executive of any of the member firms, replacing the Broker would not result in the organizational trauma to any of the members that could result from replacing a CEO in a bureaucracy.

In a bureaucracy, the executive level disperses funds to subordinate levels of the organization. In other words, the revenues of operation flow up the chain of command and the upper echelons control an individual unit's ability to operate (through budgeting processes) through a reverse flow of funds. The proposed model reverses these flows in a community of core corporations. Rather than a CEO determining the funding for a division, the individual core corporations fund the Broker to the level required for their community. The effect of this maintenance of control at the core corporation level accounts somewhat for the appreciable decline in the magnitude of the Broker facility when compared to the bureaucratic executive offices charged with performing similar responsibilities.

The Broker also helps to establish new firms based upon the need of the collective to exploit a new opportunity or technology. If the individual core corporations are not going concerns, their termination must result from predictable causes, to some degree. The most prevalent cause for terminating a core corporation would be its technical obsolescence. Considering the collective from the perspective of the high technology-leveraged job shop assists in maintaining an objective perspective on the individual core corporations (or stations within the shop). If one of those sub-operations, which is a core corporation, becomes outmoded or technically superceded, then for the good of the community the broker must seek to assure that the collective maintains its technical and quality edge by updating that function through the managed withdrawal and creation of firms.

As another part of the managerial role, the Broker must market the capabilities of the community to land new jobs. Existing as separate

entities, the core corporation would enjoy the freedom to perform jobs for traditional enterprises. However, their primary mission should be to fulfill the requirements of jobs assigned within the collective. Outside tasks should only fill what would otherwise amount to downtime. The degree to which the core corporations work together in job shop fashion increases the likelihood of success for the community as a whole. Therefore, motivation is properly placed within the Broker function to develop business. Failure of the community would require the core corporations to attempt success according to a more traditional business model. For the broker, failure translates into unemployment.

Once achieving success in landing a new job opportunity as just described, the Broker must dissect the job into individual tasks or core segments. Given that each firm within the collective brings a single core capability to bear, larger, complex tasks must be shared among them in order to allow each to produce according to individual strength. The dissection of the job depends to a degree on the capabilities of the firms available within the community. At times it may be necessary to work with non-core corporations to complete an overall task. These situations include areas of a job where a mass manufactured sub-assembly provides full capability and there would be no value added in recreating the piece. Short-term capacity constraints may also cause the Broker to consider help outside the collective. In some nations, government or political constraints may influence this decision.

The Broker is the prime advocate of the business collective and the business model within its sphere of operation. The Broker must also identify and mitigate risks to the collective, complicated duty that will be addressed later.

The Role of the Administrator

The Administrator provides greater opportunity for efficiencies. Depending upon the nature of the tasks addressed by the community of core corporations, this function may be temporary in nature. While in any bureaucracy the middle

management staff must be constant, this does not make sense in a job shop environment where there is an ebb and flow of work.

The primary responsibility of the Administrator, as in bureaucratic middle management, is the tactical supervision of the work force in the accomplishing of a job. If there is no job to be managed, there is not a need for an Administrator (or middle management). If the task is sufficiently narrow in scope, an Administrator may not be required. In this case, the Broker would extend his/her responsibilities to accomplish the Administrator's role, augmented by supervisors in the involved core corporations.

As tasks become more involved, however, an Administrator would handle the coordinative duties typically assigned to middle managers and junior executives of a bureaucracy. This frees the work force in the representative corporations to concentrate on their core capabilities. Figure 1 illustrates the relationship between the Administrator (A), core corporations working on a more involved job, ($C_1 - C_3$), and the Broker (B). Logically, the Administrator will come from the senior technical ranks of one of the core corporations involved in the assigned task (such as C_1 , C_2 and C_3).

The benefits of appointing a senior technician as Administrator are multiple. Primarily, given that the assignment is temporary, once the core community completes the job, the Administrator can move on to a productive position on another assignment. This contrasts greatly with a bureaucracy where middle management continuously exists. For example, consultants who work job fairs or college recruiting often receive those assignments because they are "uncovered." In other words, they have a management position with no current managerial responsibility so they get stuck doing these other jobs.

Another significant benefit to appointing a senior technician as Administrator is related to the duties assigned this function that include leadership opportunities where knowledge of the job and tasks involved are critical to the success of the venture. Chief among these duties is to encourage innovation among members of the team. A job shop produces unique (or at least

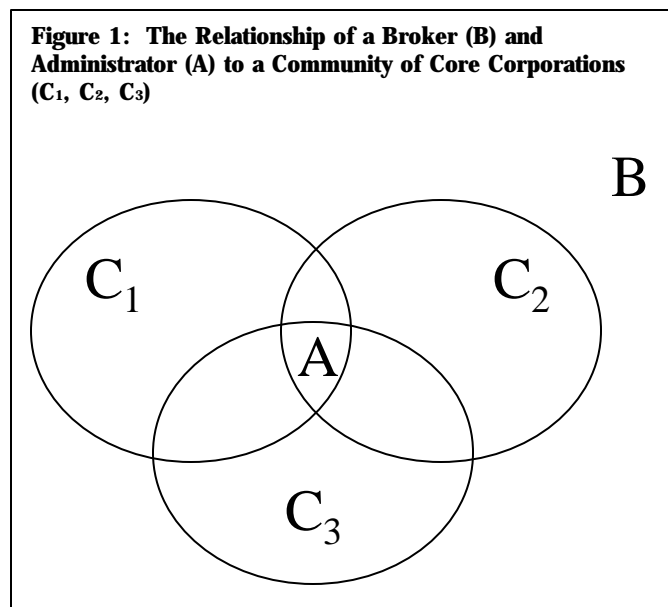
limited run) items based upon the customer's requirements. This environment fosters imagination and should encourage evolutionary development of new products and services. Other Administrator tasks include managing cross-firm communication, shepherding synthesis of the final product, and establishing concurrent engineering. Since the core corporations are each technology-based firms, communication is aided when the individual charged with inter-firm communication possesses sufficient technological knowledge to understand the details of the sub-tasks assigned to each company.

The Impact of Technology on Organization

Information technologies, when applied appropriately to organizational systems, unlock flexibility in a firm by providing the key to integration. This is the promise of the core corporation model. These firms go beyond the integration of the latest generation of technology. They exist only because of the technology.

The Dimensions of Adhesion and Cohesion

The integrative facilities provided by information technology manifest themselves in two primary ways:



Adhesion: This avenue of integration stems from the concept of the *coefficient of control*. Based upon giving support and maintaining loyalty, adhesion measures an organization's ability to uniformly comply with directives coming from the senior leadership. A high degree of adhesion provides an organization the ability to quickly congregate its resources to present a unified front in the face of a threat, or to nimbly realign itself in pursuit of a brief window of opportunity.

Cohesion: This avenue of integration refers to the extent to which an organization's components constructively complement one another, such that the working whole is equal to something more than the mere sum of its parts. The synergy resulting from a high degree of organizational cohesion will complement and amplify the flexibility achieved through adhesion alone.

As the complexity of an organization grows, the evolution of its structure will result in conditions that tend to make it either more disposed or less naturally well-disposed along each of these two lines of integration. In light of available information technology, companies must query whether the "natural" level of integration suffices for their operating environment.

The criticality of *adhesion* increases proportionately to the increase in volatility (both rate and magnitude) of the contextual changes an organization encounters. On the other hand, *cohesion* would be of paramount importance in contexts where efficiency in one form or another centrally determines organizational success. Figure 2 tabulates how these two integrative forces apply to organizations on the two dimensions of context that affect them.

Environmental conditions constitute the matrix of exogenous influences to which commercial or industrial enterprises might be subject. The range of exogenous influences to which any firm is susceptible will depend on factors such as its degree of geographical

dispersion (local, national or multi-national), the particular industry sector in which it is located (in terms of susceptibility to regulation, political pressures or other formal influences), the extent to which it depends upon trade, and other factors germane to specific industries.

The spectrum of environmental instability ranges from the mundane to the fantastic. The mundane include minor changes in interest rates, tax structures or other macroeconomic parameters. The fantastic include changes resulting from majority control in Congress for firms heavily based in government business. The degree of adhesion required within an organization to assimilate environmental shifts moves in concert with the position of the organization along this spectrum of instability.

Cohesion provides greater value to an organization experiencing dramatic, sweeping changes in its operating environment. Shifting, exogenous influences would place pressure on the elements of an organization to continually redefine its interfaces to maintain its operation efficiency. Strong cohesion among the various elements of the organization provide the strength to draw together and execute the shifts in posture with agility demanded by the environmental changes.

On the competitive dimension, firms engaged in extensive oligopolistic competition—a market situation in which each of a few companies affects

Figure 2: How Integrative Forces Impact Organizations: Implications of Integration on Contextual Dimensions

	Environmental	Competitive
Adhesion	Firms subject to rapid, radical (revolutionary) changes in exogenous operating conditions.	Business Enterprise engaged in innovation-driven markets characterized by extensive product differentiation and technological obsolescence.
Cohesion	Firms likely to face only gradual and incremental (evolutionary) changes in external influences.	Firms operating in efficiency-driven markets where price is the key arbiter of market share (and cost containment is critical to competitive pricing).

the market, but does not control it, would require a high degree of adhesion to achieve the flexibility necessary to thrive. Increasingly, firms find that advantages of scale alone do not provide the lasting benefits characterized by the mass producers and retailers of years past (Reid, 1995). Oligopolies rely on a rapid pace of innovation to sustain monopoly-like profits by achieving sole-source supply of an essentially novel product for a (usually) brief period. These firms constantly risk getting caught short of the innovation race, of finding themselves committed to a product that has suddenly become superseded by an agile competitor's creation. This constant pressure to invent and customize the product offering creates the flexibility and ability to react brought about by organizational adhesion critical to the success of the firm.

For its part, cohesion provides a vital ingredient of competitive integrity for firms engaged in markets where opportunities for innovation or perceived meaningful (versus obviously cosmetic) product differentiation are constrained. This stems from the nature of the product or service in this scenario that does not usually allow much latitude for quality-related distinctions. It may also stem from regulatory restrictions limiting the types of competitive initiatives that firms can direct against one another. In these situations, market share strongly correlates to price.

The core corporation provides a balanced application of organizational drivers to increase the degree both of a firm's adhesion and cohesion. Regarding sufficiency, a firm's proper level of integration must be considered in light of its environment and competitive context. Regardless, the informed application of information technology to a core corporation provides managers with the comfortable likelihood of achieving too great a level of integration rather than not enough.

Galbraith (1993) described the importance of developing and identifying organizational capability in order to anchor long-term earning potential since advantages of size, economies of scale, and barriers to entry no longer protect as they did. As technology provides smaller firms with the ability to overcome these traditional large

business advantages, most firms will experience a greater level of rivalry in their industries. As a result, "companies need responsiveness and organizational flexibility in responding to increased customer choice" (p. 3). Identifying core competencies and networking with other core corporations provides a major source of flexibility in responding to the intricate and changing desires of customers.

The Dimensions of Interaction and Coupling

Charles Perrow (1984) provided a convenient framework for defining the core corporation. In *Normal Accidents*, he divided the corporate world into four categories based upon two parameters: degree of interaction and degree of coupling among the units of the organization. The degree of interaction in a company falls within a spectrum from linear (systems characterized by spatial segregation, dedicated connections, extensive understanding and segregated subsystems), to complex (systems with closer proximity of its parts, common-mode connections, feedback loops and limited understanding). The spectrum coupling in an organization stretches from loosely coupled to tightly coupled. Loosely coupled systems include characteristics that enable them to absorb shocks and pressures to change without destabilizing operations. Tightly coupled organizations, in contrast, will respond more quickly to change, but the results of external influences may be catastrophic. The important aspect in Perrow's model is its emphasis on organizations as systems.

Loosely coupled, complex organizations include universities, research and development firms, or multi-goal government agencies such as the Department of Energy or the Office of Management and Budget. Loosely coupled, linear organizations include assembly line production, trade schools, most manufacturing, and single-goal government agencies such as the Post Office. Tightly coupled, linear organizations include dams, rail and marine transport, or airlines. Tightly coupled, complex organizations may include chemical plants, space missions, or nuclear plants. Each of these categories of

organization requires a different approach to control and authority structures. Figure 3 presents Perrow's proposal for effectively establishing authority structures in each class of firm. Perrow intended to show how complex, tightly coupled organizations could not exist due to the dichotomy of authority structure required to manage it. However, with properly applied information technology, this definition suits splendidly for establishing the first major characteristic in the definition of the core corporation.

Prior to the maturing of information technology, a complex and tightly coupled organization would have self-destructed as it strove to achieve simultaneous centralization and decentralization of its control structures. In the spirit of trying to implement classical Mayo, Taylor, or Bernard theories of management, the organization would implode through the struggles to centralize control in order to manage a tightly coupled firm, yet decentralize control to allow individual units the flexibility to respond to threats and opportunities. The core corporation can capitalize both on the innovation possible through complexity and the power possible through tight coupling. Through the integrative capability of information technology, managers of the core corporation can achieve the immediate control desired through centralization while affording the capacity for decentralization required for units to operate most effectively. Given that information is a major ingredient in the measure of the centralization/decentralization debate, an effectively implemented suite of information technology will allow for swift and often transparent shifts along the continuum of location of control.

Davidow and Malone (1992) crystallized a trend developing in industries around the world faced with the challenge of a simultaneous requirement to centralize and decentralize upon demand. Increasingly, firms find that they cannot depend upon monopoly-like profits for a new product or service brought to market. Product life cycles continue to shrink as technology enables more rapid production of imitations. This phenomenon underscores the need for transition to a core corporation structure. With the power

of integrative facilities, the core corporation can maximize the innovative capacities of its units in bringing products to market while simultaneously supporting the decentralized manufacturing units charged with maintaining the highest margin on a product that the market will bear. This concept works best in an oligopolistic market structure in which each of a few producers affects, but does not control, the market.

Bureaucracy versus Adhocracy

A final issue characterizing the core corporation relates to its place in organization theory. The core corporation is not a bureaucracy. It depends less on hierarchy, operates with less formality in design, and tends more toward the behavioral sciences and the contributions of systems theory. Due to the highly technical nature of the core corporation, management must demonstrate a high level of technical competence. Dealing with a skilled technical staff requires adoption of a McGregor Theory Y organizational philosophy. Theory Y provides for the integration of individual goals with those of the organization. This violates the Weber model of bureaucracy in

Figure 3: Control Structures Relative to Corporate Coupling and Interactions

	Linear Interactions	Complex Interactions
Tight Coupling	Centralization for tight coupling. Centralization compatible with linear interactions (expected, visible).	Centralization to cope with tight coupling (unquestioned obedience, immediate response). Decentralization to cope with unplanned interactions of failures (careful search by those closest to the subsystems).
Loose Coupling	Centralization or decentralization possible. Few complex interactions; component failure accidents can be handled from above or below.	Decentralization for complex interaction and for loose coupling desirable (allows people to devise ingenious substitutions and alternative paths).

establishing offices and hierarchies, administration of strict rules, and clearly defined division of labor (Wren, 1987). To achieve strategic advantages and quickly exploit an emerging market, core corporations must seek partners who bring complementary core skills that, when joined with their own, provide a complete set of skills to address the market. Hamel, Doz and Prahalad (1989) suggested several guidelines under which this collaboration may produce mutually winning situations without jeopardizing any of the participating company's survival:

The partner's strategic goals converge while their competitive goals diverge. That is, each partner allows for the other's continued prosperity in the shared business. Philips and Du Pont collaborate to develop and manufacture compact discs, but neither side invades the other's market. There is a clear upstream/downstream division of effort.

The size and market power of both partners is modest compared with industry leaders. This forces each side to accept that mutual dependence may have to continue for many years. Long-term collaboration may be so critical to both partners that neither will risk antagonizing the other by an overtly competitive bid to appropriate skills or competencies. Fujitsu's 1 to 5 size disadvantage to IBM means it will be a long time, if ever, before Fujitsu can break away from its foreign partners and go it alone.

Each partner believes it can learn from the other and at the same time limit access to proprietary skills. JVC and Thomson, both of whom make VCRs, know that they are trading skills. But the two companies are looking for very different things. Thomson needs product technology and manufacturing prowess; JVC needs to learn how to succeed in the fragmented European market. Both sides believe

there is an equitable chance for gain (p. 135).

Characteristics of the Core Corporation Model

The uniqueness of external relationships sets the core corporation apart. In summary, the characteristics of the core corporation model include:

- It operates in a highly technical industry or segment of an industry, whether private (such as computers or aerospace) or public (such as NASA or Defense research).
- The firm may or may not have a complex organization, but will most certainly operate in a volatile environment.
- The organization will tend toward McGregor's Theory Y model rather than Weber's bureaucracy.
- The firm is built around a single (often proprietary) technology, although it may include several product lines.
- The organization will encourage cooperation among related organizations to foster joint growth.

A key factor of the conceptual core corporation as presented in this paper is that it could not have existed prior to the advent of information technology, and may not be able to exist yet without further enhancements in information technology. Functions for which this model fit can be accomplished without a core corporation structure; but the model is intended to demonstrate how, at least for appropriate applications, a core corporation could accomplish these functions with significantly increased efficiency.

Integrative Facilities Enabling the Core Corporation Model

To successfully transition from the monolithic management mindset toward the cohesiveness of a core corporation, executives must employ the

integrative power of technology, particularly along the lines indicated in Figure 4.

Placing emphasis on integrative facilities argues for at least two critical companion changes within the organization. First, management must approach the design of support systems from a *top-down* perspective, rather than the common bottom-up approach fostered out of respect for the individual's knowledge of the task. To achieve effective integration, support systems must subordinate the interests of specific individuals or singular organizational units to the interests of the enterprise. This approach requires an aggressive retreat from popular, but basically segregative (bottom-up) approaches such as an emphasis on end-user computing or local decision support systems. Bottom-up approaches have consistently led to data bases that cannot interface, collections of application programs that cannot share data or learn from each other, multiple development of relatively basic applications (such as payroll programs) for each subset of an organization where a single robust application would suffice; from there, development of management support systems that will not support basic decision making requirements follows logically.

As a corollary to top-down design of management support systems, a second critical organizational change requires a determined decrease in the reliance on fragmenting (or decentralizing) information technologies. Personal computers and workstations have increased the individual's productivity, sometimes

several-fold. Lacking careful planning, though, management purchases the individual's increased productivity at the expense of overall organizational effectiveness by correspondingly decreasing integration of work processes. To achieve integration, organizations must achieve the integrative characteristics inherent in mainframe-anchored configurations using centrally controlled intelligent terminals as satellites. The nature of mainframe computing carries a high degree of natural integration. Whether employing centralized computing through hardware or through software constraints on networked, smaller processors, organizations must strive to increase their use of consolidative (or centralizing) techniques such as multi-access resources (shared data sets and applications), multipurpose machines (for example, using process control systems to perform administrative tasks in the background), and dynamically configurable, wide area multi-media networks.

Both of these requisite changes speak to the heart of a main concern of chief executives in North America and Europe (CSC consultants, personal communication, circa 1993)—aligning information technology and corporate goals. To achieve the greatest gain for a firm's IT investment, to achieve organizational integration and the resulting economic benefits, management must unequivocally commit to the concept of co-determinacy between organization and information systems structures such that changes in the latter can author changes in the former, rather than just the reverse.

Figure 4: Families of Integrative Facilities Related to Managerial Functions

	Adhesion (Vertical Integration)	Cohesion (Horizontal Integration)	Collaboration (Reticular Integration)
Strategic (Planning)	C2-type network architectures, centrifugal dissemination of planning data and centripetal uploading of real-time situation data.	Local Area Networks for emulating and enforcing the informal organization and the TeamNet factor.	Intelligence-driven planning; Open system features to support access to external networks.
Tactical (Control)	Consolidated management support systems via org-wide DSS, Intelligence processing; POS support.	Enterprise-wide MIS approaches; data standardization.	Janus-like processes for external intelligence processing; data fusion to collate diverse data.
Operational (Problem Solving)	Expert Systems or knowledge based models; federative allocation of decision options.	Conjunctive process control subsystems; resource optimization routines.	GDSS, groupware, tele-conferencing support.

The model represented in Figure 4 is based upon the principles of systems theory. This perspective allows for solutions that go beyond the traditional IT role of improving processes to inventing new processes for accomplishing core business functions. It allows for gains in efficiency to be measured in orders of magnitude rather than as a percentage increase.

Integrative Technology Supporting Adhesion

While information technology increased in popularity and availability over the past several decades, many self-proclaimed authorities from the emerging industry prophesied of tremendous increases in productivity resulting from the investment in computers. Surveys of top executives have demonstrated that their companies have not realized these promised gains in productivity (Woolfe, 1993). The failure of information technologists to deliver productivity gains according to the established expectation, regardless of the recklessness of some of the claims or the sufficiency of the excuses for falling short, has generated a lot of frustration and lack of confidence in the user community.

This fundamental failing by early computer professionals created the current market for systems engineers and process designers. Business Process Reengineering (BPR) consultants particularly champion this cause. When carried out successfully, a BPR engagement will accomplish vertical integration as described in the first column of Figure 4. The degree of its success may be measured by how well the reengineers address the strategic, tactical, and operational aspects of the target unit. As noted by two of the foremost reengineering experts, Hammer and Champy (1993):

To paraphrase what is often said about money and government, merely throwing computers at an existing business problem does not cause it to be reengineered. In fact, the misuse of technology can block reengineering altogether by reinforcing old ways of

thinking and old behavior patterns (p. 83).

Using technology to automate flawed processes may actually amplify existing problems and further frustrate attempts at integration.

Integrative technologies leading toward vertical integration link various layers of a business unit. For example, the vice president of marketing would use these facilities to work with the various department managers or directors within the marketing operation. A division president would use these facilities to work with the various vice presidents. From a strategic viewpoint, management must establish a command and control architecture that supports centripetal model-based structures in order to assure data gets channeled to the top of the organization, and centrifugal model-based structures that disseminate necessary planning data to the appropriate echelons in the organization. With a centripetal model-based architecture in place for the business unit, the organization may move along the continuum of varying degrees of centralization.

Tactically, management must secure information as much as possible. Information must flow up and down the chain of command within a business unit strictly on a need-to-know basis. Implementing multi-echelon control systems will minimize the risk of having competitive-sensitive intelligence becoming available to predatory or antagonistic parties. Returning to the earlier-mentioned admonishment of increasing an organization's mainframe-like characteristics, replacing suboptimized databases with clustered, unit-wide data sets and information pools with multi-level security will contribute to achieving tactical integration for intra-unit control.

Moreover, directive decision devices such as expert systems can secure vertical integration from the operational perspective. Such facilities either influence the individual in the process by helping to make the decision, or escalate the decision up the management line where more information contributes to a more informed decision. Analytical decision aids such as knowledge-based models extends top

management influence over lower level functionaries and disciplines the activities of lower echelon managers. For example, a bookstore chain might provide individual store managers with a tool to help facilitate the ordering of stock from various publishers where the parameter of quantity allows for a range of figures controlled by the headquarters office. Often, these systems may be implemented such that the operational levels of the organization do not realize the extent of this influence. A dynamic federative protocol is the underlying chord that brings the integrative technologies for vertical integration into harmony. Basically, individual business units assume responsibility for all functions except those explicitly assigned to the next senior level in the organization. The addition of information technology to this protocol provides for a degree of effective centralization such that more of the responsibility may shift to higher echelons as dictated by the environment.

Integrative Technology Supporting Cohesion

By facilitating peer communication at all levels and across subunits within an organization, horizontal coordination as shown in the second column of Figure 4 provides firms the ability to recognize and exploit new opportunities. While vertical integration focused on moving information up and down the formal chain of command, horizontal integrative facilities can foster the informal organization by assisting in the dissemination of information across functional boundaries. Whether strategic, tactical, or operational, information technology will enhance inter-unit integration within the overall organization by substituting coordination and cooperation for competition. It should be noted that although the facilities described in this section may appear to contradict those of the previous section, the context has changed to describe inter-unit rather than intra-unit workings, and the nature of the data has changed as well to broader, less sensitive information which reduces the risks of compromise.

The implementation of cohesive integration technology does not differ substantially from the

core corporation to other types of organization. Successful collaborative integration depends upon having properly established both adhesion and cohesion within the organization.

Integrative Technology Supporting Collaboration

The concept of a core corporation almost certainly demands a centralized organization. When a company strips itself of the spurious functions that did not contribute directly to its main functions, it helps create a more agile structure able to more quickly respond to the changes in its industry and attacks from its adversaries. A core corporation can make up for the loss of bigness through two currently known types of arrangements:

- A long-term association with suppliers and dealers of its products similar to but less formal than Japanese Keiretsu.
- Shorter term arrangements established for the purpose of accomplishing a specific task or mission, and then probably dissolving. These arrangements typify the subcontracting relationships established in government contracting.

Both of these relationship types require a degree of integration with the core corporation to achieve success. A third option, as yet as untested as the core corporation itself, would call for a more collegial relationship between various core corporations. Less rigid than the first two options, this choice would rely more strongly on the integrative technologies described in the last column of Figure 4. Perhaps most unique to the challenges of operating as a core corporation are the trans-organizational issues. By adopting the integrative facilities depicted, the core corporation may establish productive relationships with other core corporations, large companies, suppliers and clients with far greater efficacy than the traditional arms-length contracting might provide. Again as noted by Hamel (1989), collaboration is in fashion—even more so now with the continued acceleration of developing technology. Small firms joining in strategic cooperative relationships with other firms, large or small, will create the

opportunities to more quickly develop capability while providing the partner firm with specific expertise. The integrative facilities shown in Figure 4 can further accelerate the technology transfer.

Model Risks

Every theory has its limits. Even in its prime setting of a high-technology job shop scenario, though, the community of core corporations would face risks not as prevalent in a more stable bureaucratic setting. Some of these risks can be managed; others must be recognized and to some degree accounted.

A significant issue that places the health of a core corporation at risk is the loss of intellectual property. The value of individuals to the organization is amplified where in the traditional bureaucracy it is subdued. The core corporation fosters the imagination of its employees and nurses the entrepreneurial spirit in those responsible for accomplishing its work. Employees are afforded a greater opportunity to make a contribution, and therefore see a greater relationship between their contribution and their rewards. Because the core corporation places greater emphasis on the innovative spirit of its employees, the impact on operations might be severe if one of these knowledge workers left the firm.

The Broker can play a role in mitigating this risk. In the responsibility of managing the ingress and egress of firms, the Broker should work to transition the quality employees from the retreating firm to the advancing. This transition is more important if the incoming firm is replacing the dying firms role in the community of firms. The success rate may not be perfect, but the effort must be significant for the well being of the collective. Even in a stable environment, the Broker must allow for the transition of employees within firms if necessary to maintain the knowledge. This job rotation within a small group would not be without precedent. Senior engineers in areas such as North Carolina's Research Triangle Park or California's Silicon Valley have made successful careers in the geographical region, but not the same firm.

Another risk to this model is that a community of core corporations may brush too close to the business of a corporate giant that decides to engage in a costly price war. This manipulation of microeconomic effects is anathema to the core corporation, yet they do not have the option of refusing to engage. The best defense for this offensive behavior is to innovate. Given the core corporation's superior flexibility and work environment that fosters the employees' imaginations, they should be able to turn price wars into short skirmishes. The community of core corporations should easily out duel a bureaucracy large enough to engage in price pressure tactics by bringing new products to market more quickly and re-establishing product differentiation.

The model of core corporation production weights inter-firm collaboration heavily. Disputes between firms pose a significant risk to the efficiency of the system. This issue might fall either to the Broker or the Administrator to resolve. The critical issue is to identify these risks to the model and assure that they are addressed. Even with Broker involvement, though, this may be one area of risk where the Broker has limited mitigation authority, shy of losing one of the firms.

Technical obsolescence is not unique to the core corporation model, but its impact is perhaps more severe than in a less dynamic environment. Both the Broker (through sensing the environment and issuing in new firms), and the Administrator (through encouraging innovation and cross-firm communication) have responsibilities intended to mitigate this risk. The nature of technology is such that even the greatest management could be surprised by the innovation of a competitor.

A final basic risk to the core corporation model is the opportunism and self-interestedness to which any member firm might fall prey. If one of the member firms finds an opportunity to abuse the code of behavior by which all firms prosper, the balance of the system is in jeopardy. The Broker must have sufficient insight into the fiscal operations of each firm to guarantee compliance with the communities expectations. More importantly, the Broker must either wield the judicial authority to punish such firms or

convene a representative body from the community to handle the problem.

Finally, a caution: as a firm embraces the integrative facilities offered by information technology, it will likely face the centuries-old temptation to continue to enrich its capabilities through growth, diversification, acquisition, or any other convenient path. A firm operating effectively with 100 employees may find they could now double the size of their organization with no loss of effectiveness through the application of these integrative facilities. This tendency introduces the firm to the vulnerabilities of diseconomies of scale associated with increases in size and diversification (Sutherland, 1980). Most companies in this, the information age, have access to information technology. The application of the technology separates successful companies from those merely existing or failing. A risk in applying information technology poorly is that it will mask the diseconomies that may destroy a company slowly, as an undiagnosed cancer works on a body until, when found, is often too late.

Concluding Comments

Many theories exist regarding the path to greater competitiveness in a world economy. Most of these theories deal in large part with improving productivity. From a macro-economic view, Baumol's (1985) theory on maintaining competitiveness includes three distinct and interrelated factors that should underscore any effort to improve efficiency:

- Enhanced innovation;
- An increased rate of investment; and
- An unleashing of the market mechanism and its powerful incentives for unceasing effort by management to outstrip its own past performance as well as that of its rivals (p. 188).

In a micro-economic application, this paper proposes that the integrative facilities presented in the core corporation model will foster an environment conducive to innovation, almost certainly require an increased rate of investment, and encourage the market mechanism to its

fullest. Quality examples of the theory of core corporations do not exist. The principals of the model rest on quality of goods, quality of services, employment integrity, and adherence to the microeconomic principals of a free market economy. While it may be argued that examples of a pure bureaucracy are equally elusive, the tendency toward bureaucratic principals is certainly more prevalent.

The hope for the future is a close analysis of the burgeoning e-commerce community. Surely this emerging breed of firm must prize flexibility and quality highly enough to be willing to risk new types of organizational structures and systems to avoid the strangling effects of scientific management. As the world economy now graduates from its blind infatuation with the e-commerce community and requires the same return on equity expected of brick and mortar establishments, the opportunities will emerge to measure the differing characteristics between the survivors and those forced to merge in order to survive.

More immediate analysis might be accomplished to determine the feasibility of subsets of the core corporation principals. For example, an empirical study could highlight the working condition preferences of information technicians specifically as they relate to large and small firm environments. Another potential avenue of discovery is the willingness of small high-technology firms to enter into less rigidly defined relationships and alliances than typically found in legalistic contracting.

The core corporation model is not intended to supplant bureaucracy or revolutionize the world economy. Given the pace of transactions in the current era and the shrinking life cycle of products, though, information technologists must find ways of making order-of-magnitude changes for firms in the most volatile environments.

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