VIRTUAL ORGANIZATIONS:
WHAT YOU SEE MAY NOT BE WHAT YOU GET

Raghu Garud
Management Department
Leonard N. Stern School of Business
New York University
40 West 4th Street, Suite 7-13
New York, NY 10012-1126
(212) 998-0255
fax: (212) 995-4235
rgarud@stern.nyu.edu

Henry C. Lucas, Jr.
Department of Information Systems
Leonard N. Stern School of Business
New York University
44 West 4th Street, Suite 9-67
New York, NY 10012-1126
(212) 998-0814
fax: (212) 995-4228
hlucas@stern.nyu.edu

March 1997

Working Paper Series
Stern #IS-97-3

Virtual Organizations: What You See May Not Be What You Get

ABSTRACT

Virtual organizations are new organizational forms comprising a set of network transactions that differ from those found in markets and hierarchies. This paper explores the nature of these network transactions through an in-depth study of a virtual firm. The virtual organization is characterized by constant organizing through virtual teams and alliances, a unique management culture and a set of norms, information and knowledge sharing enabled by information technology, and employee self-governance. The organization gains from a culture of fast-response and efficiency while employees are trusted to exercise discretion and take initiatives.

Center for Digital Economy Research
Stern School of Business
Working Paper IS-97-03

Virtual Organizations:
What You See May Not Be What You Get

Verifone offers "real life techniques for running a virtual corporation" (Will Pape, Presentation December, 1996)
"The culture is one of urgency."
"The culture is one of trust. (Katherine Beall, Interview January, 1997)"

The statements above come from two employees of VeriFone, a "virtual" corporation. Even a decade ago, it would have been difficult to have imagined the design of such an organization.[1] Now, as VeriFone and others are demonstrating, such virtual organizational designs are not only possible, they are essential to strategic success (See Table 1 for several examples of Virtual organizations).

Indeed, Daft and Lewin (1993) suggest that "the design of the organization itself has once again emerged as a new strategic variable. The design of organizations that are flexible, that adapt and create change, that more fully use both human and technology resources, and that are global in scope, are perhaps the most significant variables of the new forms....New organization forms open up new sources of sustained competitive advantage."

- Insert Table 1 about here-

In this paper, we seek to answer two questions: ***what are virtual corporations and how are they governed?*** Our purpose is to identify the essential characteristics of virtual

[1] Where did the term "virtual organization" originate? In the early days of time-sharing computers, a combination of hardware and software was used to provide a program with the appearance of more logical memory than the physical memory of the computer. This "virtual" memory was many times larger than the actual physical memory available to the program. "Virtual" refers to a component of the computer that functions as if it is real, but instead is simulated using a combination of hardare and software.

organizations through an in-depth analysis of a single firm, VeriFone. We believe that this company's virtual characteristics provide it with a significant competitive advantage. As we shall see, information technologies are central for the realization of virtual corporations. The technologies that are particularly important include e-mail, groupware, shared databases, video conferencing and computer networks. These technologies help managers create virtual components of organizations and cross-functional teams that can be global in scope.

The paper is organized as follows. We first provide a brief introduction to governance modes that have been important in organizational studies. Our introduction sets the stage for presenting the key issues in understanding virtual corporations. We then employ these orienting concepts to explore VeriFone. Our study of VeirFone is the basis for insights on essential elements of virtual corporations. In our conclusion, we discuss the implications of our work for both theory and for practice.

VIRTUAL CORPORATIONS & ORGANIZATIONAL GOVERNANCE

Virtual organizations differ in the extent to which they are virtual. All make use of some virtual relationships or use virtual organizational components. A characteristic that differentiates these firms from traditional organizational structures is their network mode of governance. The traditional firm confronts transactions costs in uncertain markets because of bounded rationality and the possibility for opportunism. A fundamental question is whether to incur the transactions costs of the market, or whether to internalize transactions costs through a hierarchy.

The network approach to transactions represents a contrast between *bargaining* transactions carried out within markets and *administrative* transactions carried out within hierarchies (Powell, 1990). Several authors have argued that administrative transactions within a hierarchy are better able to preserve and leverage knowledge compared with bargaining transactions in a market (see Kogut & Zander, 1992; Garud & Nayyar, 1994). For instance, Kogut and Zander suggest that firms possess combinatorial capabilities that are not readily found in markets. Garud and Nayyar maintain that firms are essentially repositories of knowledge that can be activated at different points in time, leading to synthesis and competitive advantage. This synthesis is difficult to accomplish in atomistic markets that are not conducive to the preservation of knowledge.

Firms, though important in the creation and management of knowledge, are nevertheless insufficient by themselves. As knowledge becomes more complex[2], it becomes increasingly difficult to contain all relevant knowledge vectors within the confines of a single firm, however large it may be. Specifically, the deployment of complex knowledge over many products and markets results in congestion, thereby causing bottlenecks "in the form of over-extended scientists, engineers, and manufacturing and marketing personnel (Teece, 1980:232-233)." Therefore, firms have to focus on certain core competencies and rely on other firms for complementary ones; this need to rely on others provides motivation for entering into virtual relationships (Teece, 1980).

[2] By complexity, we imply the multi-disciplinary bases of information required to create knowledge in the form of new products and services (Winter, 1987).

When firms manufacture only certain components and enter into virtual relationships for others, they "partition" knowledge (Demsetz, 1993). Such partitioning of knowledge can create an organizational system whose modules (firms) can engage and disengage in response to market and technological changes (Miles and Snow, 1986; Garud and Kumaraswamy, 1995). However, for such "flexible specialization" (Piore and Sable, 1984) to yield compatible knowledge, these organizational modules need to coordinate their activities.

The advent of new information-mediated technologies (Lucas, 1996) enables coordination among firms (Fombrun and Astley, 1982). If we view firms as modules of knowledge, technologies such as e-mail, electronic data interchange, groupware and the Internet enable connections among these modules and promote inter-firm coordination (Malone, Yates and Benjamin, 1987). These technologies reduce transactions costs, thereby facilitating the management of decentralized and virtual relationships (Quinn, 1992).

The web of relationships that emerges when firms begin relying on others for complementary assets represents network transactions. These transactions, unlike their market counterparts, have relational attributes to them. Relationship transactions provide network players the flexibility to co-evolve in an ambiguous environment (Macneil, 1980). In this sense, network transactions are similar to hierarchical transactions even though they are executed *between* firms. Moreover, network transactions also bring into play socially created rules that bind network members. These rules change in a dynamic manner through the mutualistic adjustment of network participants. Changes occur even

as a new technology-regulation space is created through a synthesis of new and old regulations. Thus, networks include bargaining, administrative and rationing transactions.

Recently, network transactions have received considerable attention from researchers pursuing various disciplinary perspectives (see Nohria and Eccles (1992) for some recent contributions). For instance, institutional economists have examined network transactions recognizing that they might be efficient when disturbances between economic actors are infrequent and when interrelated firms are dealing with assets of intermediate levels of specificity (e.g. Williamson, 1991). Institutional sociologists have studied issues such as trust, reputation, embeddedness, structural holes, and the strength of ties in organizational communities (Granovetter, 1973; 1985; Fombrun, 1986; Galaskiewicz, 1985; Dore, 1992; Fombrun & Shanley, 1990, Powell, 1990l; Burt, 1992). Legal scholars have viewed network transactions as relational contracts (Macneil, 1980). Melding insights from these various perspectives, organizational theorists have explored network forms that include kieretsus (Abegglen & Stalk, 1985), dynamic networks (Miles and Snow, 1986), and virtual corporations (Davidow & Malone, 1992).

Common to this literature is an appreciation that conceptualizing social and economic relationships in network terms allows us to see the whole *and* its parts. Each part represents a core competence that together, with competencies possessed by other parts, creates a technological system (Hakansson, 1989). Consequently, firms that belong to a network confront a tension between cooperation and competition. For instance, it might make sense for firms to cooperate to set overall industry-wide technological

standards. At the same time, these firms might compete to have their product attributes built into the emerging standards.

Virtual organization should be viewed from the perspective of such an emerging network mode. Network transactions may be found in dynamic networks and virtual corporations (e.g. Miles & Snow, 1986; Davidow & Malone, 1992; Meyer, Goes & Brooks, 1993) and keiretsus (Abegglen & Stalk, 1985). The components of a transactions-linked network are each capable of rapidly re-configuring their value elements to provide a variety of goods and services to customers.

Virtual organizations are a form of network organization, one that is mediated by information technology. A virtual organization requires a specific management culture and set of norms to succeed. The virtual firm must be concerned with trust and self-governance. The virtual firm is also highly interdependent on a day-to-day basis with organizational components supplied by others. For example, Calyx and Carolla works with its growers and with Federal Express as if they were part of the company.

RESEARCH SITE AND METHODOLOGY

Daft and Lewin (1993) suggest, "Probably the least promising approach to help define new organizational paradigms is traditional hypothesis-testing research." Accepting this advice, our paper relies on the careful case study of a single firm. We believe that many of the characteristics of VeriFone can be generalized to define a new organizational form, the virtual organization.

We employ a grounded approach to theorizing; specifically, we employ "constant comparison" as suggested by Glaser and Strauss (1967). Constant comparison consists of

comparing emerging constructs with each other to design more robust ones that then can be related with one another. It requires the comparison of these emerging constructs with those we have been using before as a point of departure – in this case the constructs that are usually employed to define traditional organizations.

Although we derive insights from our research efforts with several virtual corporations, in this paper, we focus on VeriFone. Such a focus allows us to offer observations that have some degree of coherence and integrity within the confines of one organizational context. Both archival and interview data contirbute to the analysis. Based on publicly available information on VeriFone (including an in-depth Case (Galal et al., 1995) and the Verifone Web site at http://www.verifone.com), we developed a set of questions for VeriFone employees (a copy of our interview protocol is attached).

These questions formed the basis for interviews with executives, including Will Pape, the former CIO and current advisor to VeriFone's board and Katherine Beall, the VP of Human Resources at Verifone. These interviews were transcribed and two researchers studied this material to identify themes on organizing in virtual environments. These themes, along with the publicly available information on VeriFone, formed the bases for our observations.

VERIFONE: THE VIRTUAL CORPORATION

History and Characteristics

William Melton founded VeriFone in 1981 to provide a simple check verification system; the company's products soon expanded to include credit card verification. In 1986 Hatim Tyabji joined VeriFone from Sperry to take command of a poorly performing

company. Tyabji believed in a flexible organization structure and in the importance of being close to customers to provide a fast response to their needs (Galal, et al., 1995). The early history of VeriFone is described as "Five people in four locations with almost no capital who grew a $400 million business world-wide. (Presentation by Will Pape, December, 1996)" VeriFone faced strong competitors in its early days in the form of AT&T, GTE, Northern Telecom and Mitsubishi, to name a few.

VeriFone's mission is "to create and lead the transaction automation industry worldwide." In 1996 the company's products processed an estimated 65-70% of credit card transactions in the world. Much of the business is in custom software that runs in the verification "boxes" and on other parts of the transactions network. VeriFone offers over 1600 programs that run on its verification devices. The firm has also formed alliances to verify and process payments on the Internet, including agreements with Netscape, several banks and Discover. Since 1986 the company has had 36 continuously profitable quarters, with 25% sales growth per year on the average.

From Organization to Organizing

VeriFone does have an ongoing structure, similar to most organizations. What makes VeriFone unique, however, is the constant "organizing" that occurs within this structure that is accomplished through cross-functional teams. An employee participant of one of these teams stated:

> "If you feel passionate about something that needs to be changed at VeriFone, you can give reasons why it's not working or you can form a team and produce results. (Galal, et al. 1995)"

Any employee who has finished a 40 hour leadership course can form a task force to address a problem. The team makes a presentation to senior management; blue collar workers have presented solutions to the CEO.

Katherine Beall describes three types of teams at VeriFone:

- Ad hoc teams form frequently by themselves; often these teams employ teleconferencing systems and members never see each other.
- Formal teams employ leaders who have been through training (at VeriFone University on-line, or at a learning center.) The team may work short or long-term, but it knows the assignment and its duration.
- Within subunit teams such as a group of engineers trying to solve a particular problem. Subunit or functional teams can be local or global.

These teams come into and go out of existence regularly. They are virtual in the sense that they span different organizations and members may be in different locations. The constant formation, activity and deactivation of teams is the mechanism through which VeriFone is constantly organizing. The formal organization structure is static while virtual teams create a dynamic, constantly changing organization.

In addition to teams within the firm, VeriFone forms alliances with other organizations. A virtual team might span organizational boundaries. In its early days, VeriFone tried to handle only core activities itself and outsource all others. Today the company has a number of alliances including one with Microsoft to deliver commerce-enabled Internet products for retailers and another with Digital Xpress to offer bundled ISDN services to various customers (http://www.verifone.com).

While organizing is a key activity at Verifone, there is a conventional organization chart that shows reporting relationships and titles. The organization is

relatively flat with the chairman having eight direct reports, the executive vice president six. Tyabji's corporate model is a decentralized network of locations; he refers to this structure as the "blueberry pancake." "All berries are the same size; all locations are created equal. (Galal, et al., 1995)." His least favorite location is corporate headquarters. (VeriFone tried to leave the "headquarters" blank empty on SEC filings, then tried "virtual" and finally had to enter "Redwood City.")

Regardless of formal structure, an employee can access any other employee directly through e-mail. Beall emphasizes the use of "point-to-point" communication using e-mail; one does not have to follow a hierarchy in order to communicate.

The focus is not on hierarchy and status. Rather, VeriFone defines the "right organization structure" as one locating employees near customers so that they continually put the customer first. The idea is that a customer in a country using VeriFone products can meet with a design engineer located in the customer's country; that design engineer can make changes in the product without approval from anyplace else.

VeriFone establishes locations to take advantage of local expertise. It has a smart card R&D effort in France which is the center of smart card activities, and a programming operation in Bangalore where there is a large number of educated, skilled programmers. In 1997 VeriFone operates in 53 locations with 2900 employees.

Employees typically refer to what the organization theorist calls power as "organizational politics." Pape reports that the chairman of VeriFone has very little use for politics. Senior management, however, does recognize that there are always questions about the degree of decentralization. What responsibilities should be vested in local units

and what decisions should be centralized? Will Pape describes it as a "dynamic tension" to maintain control of the company, but to avoid having headquarters dictate to local managers (Interview December, 1996).

VeriFone's dynamic, organizing structure did not arise from an organization chart. What allows it to function successfully with this nontraditional approach? We believe the answer to this question is in the unique management culture and norms that encourage organizing activitites outside of the company's formal structure. Culture and norms are the glue that holds the organization together.

Management Culture and Norms

The management culture and norms at VeriFone allow it to operate in an organizing mode. Two of the key characteristics of VeriFone that emerged from discussions with Will Pape and Katherine Beall are "fast response" and "a culture of urgency." As one employee described it, there is "never time to rejoice" after finishing a project because there is always something else to do. A lack of organizational hierarchy makes it easier to respond quickly. Katherine Beall felt quite comfortable giving a new employee the responsibility for coming up with a global profit sharing plan in four months.

A manager who joined VeriFone from AT&T saw a new marketing program for smaller retailers develop over the VeriFone network in less than a week. By the end of the quarter the plan resulted in $2.7 million in new sales. The executive commented that it would have taken at least three months to come up with a similar program at any of the previous, traditionally organized companies where he had worked.

VeriFone believes that one of its main strengths is a determined focus on the customer. Managers feel that leadership comes from setting an example rather than by telling employees what to do. VeriFone's mission statement is published in the language of every country in which its employees work. (See Table 2.) The company also prepares a series of "Excellence in Action" and "Excellence in Thought" notes to communicate its philosophy to the workforce. To Tyabji, the philosophy and notes form the basic blueprint for a successful company.

- Insert Table 2 about here -

Because of geographic decentralization and the existence of many virtual teams, an employee is often on his or her own; it is not unusual to be located in Atlanta and to report to a supervisor in Paris. VeriFone counts on individual initiative to achieve its goals. An Internet engineer may come up with an idea unrelated to his current assignment. He should suggest this idea to others, and he may or may not be charged with following up on his initiative. VeriFone believes, according to its stated corporate philosophy, that those who perform a job know best how it should be done. It strives to involve employees in the management of their own areas of work. There is a three-year rolling strategic plan while a calendar year plan drives work assignments.

It is clear that this culture involves mutual trust. Employees trust the company to support their actions and to encourage experimentation. VeriFone trusts its employees to take initiative and act in the best interest of the company. VeriFone tries to maintain this culture with a minimum of rules. Beall argues that it is best to trust employees and deal with problems on a case-by-case basis. As an example, she cited the practice of serving

alcohol at company functions. If an employee has a problem, VeriFone will counsel that employee rather than ban alcohol for everyone.

Decentralization geographically, decentralized decisionmaking, virtual teams, fast response and trust place a tremendous demand on the organization to process information and make it widely available. How does VeriFone use technology to facilitate information processing?

Information and Knowledge Sharing

Communications is a key activity at VeriFone. A corporate philosophy of distributing power to the lowest level of the organization possible reduces the amount of communications required to operate. At the same time, the global nature of VeriFone's operations create significant demands for communications, especially for virtual project teams. Managers communicate themselves with e-mail; there are no secretaries to print messages or enter responses. Executives in different countries might work together on the same spreadsheet in preparing a proposal. These executives can access information on bookings, shippings and revenues from an on-line database with worldwide availability.

Pape believes that no one communication tool is always right for a particular job. Table 3 shows some of the 32 different tools the company employs for communications. Travel, face-to-face meetings, and task forces are all communications mechanisms. Frequently task forces work "around the world" with conference calls scheduled so that members take turn at getting up at 2 AM to participate. To avoid overload, an effort is made to keep messages short and not bombard recipients with e-mail.

-Insert Table 3 about here-

Nohira and Eccles (1992) have criticized over-zealous proponents of electronic communications and linking for ignoring the importance of face-to-face interaction in communications. VeriFone would agree with their observation: it stresses the need for employees, while a part of a virtual firm, to interact physically on a regular basis. Large rooms in local offices facilitate group gatherings and the firm has annual meetings of different employees who work in similar functions. Every six to eight weeks, the senior management team gets together for a meeting in a different part of the world. (Katherine Beall lives in Dallas; Will Pape has homes in Hawaii and Santa Fe, while the Chairman lives in the San Francisco Bay Area.) Senior managers feel it is important for employees to know each other so they can use information technology effectively. As Will Pape stated, e-mail has the potential to be incendiary, "like running down the hall and throwing a grenade in someone's office (Interview December, 1996)." If those communicating know each other, there is less chance of an e-mail explosion.

The cost of face-to-face communications is constant travel; Tyabji reports traveling over 400,000 miles in a year. About one-third of the company's employees are on the road at anyone time, leading to an annual expenditure of over $5 million on hotels and airfare (Galal, et al., 1995). (Everyone flies coach, but gets to keep his or her frequent flyer miles for upgrades.)

VeriFone suggests that the virtual organization does not necessarily want to substitute electronic for physical interaction completely: rather the electronic and FTF communications complement each other. At VeriFone, occasional face-to-face

communications enables more regular and routine electronic communications with its advantage of reducing the constraints of time and space on interaction.

In addition to communications mechanisms, VeriFone believes in sharing information. Will Pape prepares a daily "flash" report; see Table 4. This report goes to 300 VeriFone employees daily. The report is a method for evaluating progress. Recipients can easily access the data behind the interpretation so they are not dependent on one person's view of performance. Pape sees the role of the CIO as providing information and interpretation, not just data. He is the "navigator" who keeps senior management informed on a daily basis of whether the firm is on course or not.

-Insert Table 4 about here-

Plans are posted throughout the company (including restroom stalls) and employees are encouraged to add comments to them. The company sends a video each quarter to employees' homes which includes amateur footage from various offices and countries. The firm provides so much information that it has registered more than 10% of its employees as "insiders" with the Federal Trade Commission (Panko, 1997). Employees' children are encouraged to communicate with their counterparts in other countries via e-mail.

VeriFone also shares information and knowledge with its customers and alliance partners. Before e-mail became easily available through service providers, VeriFone had suppliers and alliance partners on its own e-mail system. Today VeriFone provides videoconferencing equipment for these firms. Before going public when it had to be

concerned about releasing information, VeriFone shared its daily "flash" report with some partners.

VeriFone uses "appropriate technology," not the newest equipment. It spends about 60% as much as comparable electronics firms on information technology. Its e-mail system runs on VAX computers and many users have not moved to graphical interfaces. The daily "flash" report is character-based. (One observer expressed concern that this low IT budget and modest infrastructure could prove to be a problem as the company expands in the future, especially if its business on the Internet becomes more important.) Current technology efforts include the development of an Intranet to facilitate information sharing. The responsibility for providing content on the Internet will be distributed; for example, a new product group will create and maintain pages for its product.

Self-Governance

For a VeriFone employee, the organizing character of the company, management culture and norms and information sharing leads to self-governance. The employee may not have extensive physical contact with a supervisor. This employee is encouraged to take the initiative in coming up with new ideas for improving VeriFone, its products and/or its service to customers. She will communicate using a variety of media with customers, alliance partners and other VeriFone employees. She may start a virtual, cross-functional team and be a member of several others. Her major focus will be on responsiveness and fast response to conditions in her local environment.

However, information technology means that she is not constrained to local solutions; VeriFone is able to marshal its global resources to solve local problems. An

actual example helps to illustrate this global search. A customer told a sales representative in Greece, based on a VeriFone competitor's statements, that VeriFone lacked a certain product. The sales rep sent a single e-mail to "ISales," which reached all sales reps worldwide, asking whether VeriFone had a product for this customer. A sales manager in San Francisco took on the task of heading this virtual task force. He collated 100 replies and constructed a Powerpoint presentation for the sales rep in Greece (while the rep slept). The sales manager had the presentation translated to Greek, and the sales rep took it to his client the next day. VeriFone won the account.

A combination of management structure, culture and technology provide the opportunity for a virtual organization like VeriFone to manage through self-governance. At the same time, the technology makes it possible to bring the global resources of the firm to bear on local (or global) problems where ever they arise.

THE ESSENSE OF A VIRTUAL ORGANIZATION

VeriFone's operations provide many interesting insights on the design of virtual organizations. Information technologies serve as the backbone of such an organization form. Just as automation changed the bases of industrial production, information technologies are once again changing the nature of economic activities. In such an environment temporally and spatially de-coupled economic and social agents can connect and disconnect in fluid ways.

The term virtual has many other meanings, including ones of transience, fluidity, immediacy and extensibility. At VeriFone, one idealized mode of operation in a virtual organization is to form temporary teams incorporating various social and economic

agents. These agents need not be within the administrative boundaries of a single firm, nor do they need to be geographically co-located. Moreover, connected by information technologies, distributed economic and social agents can work in parallel.

As Will Pape put it, "a virtual firm is more than e-mail (Presentation December, 1996)." VeriFone demonstrates characteristics of one virtual firm that may be applicable to others; see Table 5. A virtual firm is constantly organizing itself through teams and alliances. Management trusts employees and encourages them to take initiative. There is a pervasive culture of urgency and fast response combined with a focus on responding to local conditions. Information technology enables the employees to communicate and react quickly. Face-to-face communications occurs "off-line," through meetings and visits; it does not become a barrier to a rapid response. Employees exercise significant self-governance, but have the ability to tap into the resources of a global firm.

-Insert Table 5 about here-

The idea of local responsiveness and presence combined with the ability to use information technology to perform a global search to solve problems provides the virtual organization with a significant advantage. The example of the Greek sales rep who had a local problem but could benefit from a global solution illustrates this capability.

More than technology is required to hold such a system together, however. As in VeriFone, it requires a culture where trust among the various constituent elements is the norm rather than the exception. This statement might appear to be almost axiomatic; however, it is important to explore its implications.

In a "mass production" world of traditional organizations, trust implies "compliance" at best – compliance to a set of instructions that has been generated by a manager. However, in a virtual setting, where the boundaries and nature of work are continually changing, trust as compliance will largely be ineffective. Instead, the social dimensions of trust requires initiative and "responsiveness."

Trust as compliance represents an expectation that employees will address pre-determined problems following instructions and procedures. Trust as responsiveness represents an expectation that employees will not only address predetermined problems, but, will identify and solve new problems as well. As Katharine Beal of VeriFone stated, VeriFone employees are always on the lookout for new opportunities. Moreover, the responsiveness of the San Francisco sales rep to his Greek colleague's problem is typical of operations in VeriFone.

Information technologies also involve a cognitive dimension. With a surfeit of information, the ability to make sense of the information available is as important as our ability to access such information. Depending upon the cognitive mind-set of those accessing the information, the same pieces of information can be conceptualized in different ways, thereby creating different bases for action.

This cognitive dimension suggests that the notion of trust needs to go beyond compliance and responsiveness. Constituent elements of a virtual organization must not only be responsive, but, in addition, must be committed to defining the attributes of quality and excellence. Commitment goes beyond addressing pre-determined problems. It includes a willingness to define and structure environments to define the meaning of

work itself. It requires, as employees in VeriFone demonstrate, continual sense making and sense giving in a process of mutual accommodation.

Trust as commitment is all the more required in situations where the notion of work is abstract, boundless and continually changing. In such situations, trust as commitment implies not just attending to the problems, but defining and structuring problems themselves in meaningful ways. Clearly, from compliance to responsiveness and commitment, there is a shift in the bases of trust from one based on behaviors to one based on intellect as well.

In sum, VeriFone illustrates how, in a virtual organization, the boundaries of social and economic activities are expanding and changing continually. As these boundaries change, and as the mix of constituents comprising virtual components change, distinctions between principals and agents become fuzzy. Indeed, governance of these modes of activities is neither through markets nor through hierarchies, but through a hetrarchy that builds upon mutual accommodation and trust.

CONCLUSIONS

The purpose of this paper was to identify the characteristics of a virtual organization through an in-depth study of a single firm. There are substantial differences between virtual and other kinds of organizations. We hope our discussion of a virtual organization and the VeriFone example will promote understanding of this technology-enabled organization form.

Many new organizations, especially those like First Virtual that are built around businesses on the Internet, will adopt a virtual organization form (Borenstein, 1996).

While there are too few of these organizations to draw conclusions about their overall performance, the characteristics of the virtual firm are appealing in a technologically-based economy. Decentralization, lack of formal standards (and sometimes structure), an emphasis on communications, individual initiative, openness and information sharing define the culture of the World Wide Web as well as the characteristics of many virtual organizations. The ability of virtual firms to be flexible and respond quickly to customers and the market gives them an advantage over more slowly moving firms.

The virtual organization provides its employees with unprecedented opportunities to exercise self-control, define their own work, and take initiative. This structure provides a culture of trust and responsibility for employees. The virtual organization creates the environment for self-fulfillment called for by organization theorists like MacGregor and Likert thirty years ago. Information technology, especially a variety of communications media, makes it possible to create an organization with the culture and norms of VeriFone, and to manage it efficiently. It remains to be seen if the advantages of the virtual organization are compelling enough to motivate managers to make the changes necessary in norms, culture, information technology and organization structure to convert traditional organizations to this new form. We believe there are substantial advantages to doing so.

REFERENCES

Abegglen, J. and G. Stalk, Jr. (1985). *Kaisha: The Japanese Corporation.* Basic Books Inc., Publishers, New York.

Borenstein, N., "Perils and Pitfalls of Practical Cybercommerce," *Communications of the ACM*, Vol. 39, No. 6 (June 1966), pp. 36-44.

Burt, R. S. (1992) "The social structure of competition", In N.Nohria and R.G. Eccles (eds.) *Networks and Organizations: Structure, Form and Action*, Harvard Business School Press, Boston, pp. 366-394.

Daft. R. and A. Lewin, "Where Are the Theories for the 'New' Organization Forms? An Editorial Essay," *Organization Science,* Vol. 4, No. 4 (November 1993), pp. i:vi.

Davidow, W. and M. Malone. (1992). *The Virtual Corporation: Structuring and Vitalizing the Corporation for the 21st Century.*. Edward Burlingame Books/Harper Business, New York.

Demsetz, H. (1993). 'The theory of the firm revisited'. In O.E. Williamson and S.G. Winter (eds.), *The Nature of the Firm: Origins, Evolution, and Development*. Oxford University Press, New York, pp. 159-.

Dore, R. (1992) "Goodwill and spirit of market capitalism", In M. Granovetter and R. Swedberg (eds.), *The Sociology of Economic Life.* Westview Press, San Fransisco, pp. 159-180.

Eccles, R. and D. Crane. (1988). *Doing Deals: Investment Banks at Work.* Harvard University Press, Boston, MA.

Fombrun, C. (1986). "Structural dynamics within and between organizations", *Administrative Science Quarterly*, 31, pp. 403-421.

Fombrun, C. and W. Astley. (1982). "The telecommunications community: An institutional overview", *Journal of Communications*, 32, pp. 56-68.

Fombrun, C. and A. Kumaraswamy (1991). "Strategic alliances in corporate communities: The evolution of telecommunications 1980-1988", *Japan and the World Economy,* 3, pp. 243-259.

Galal, H, D. Stoddard, R. Nolan and J. Kao, *Verifone: The Transaction Automation Company (A),* Boston, Harvard Business School, 1995.

Galaskiewicz, J. (1985). "Interorganizational relations", *American Review of Sociology,* 11, 281-304.

Garud, R. and Kumaraswamy, A. 1995, "Technological and organizational designs to achieve economies of substitution" *Strategic Management Journal*, Vol. 16, pp. 93-110.

Garud, R. and Nayyar, P. 1994. "Transformative capacity: Continual structuring by inter-temporal technology transfer" *Strategic Management Journal,* Vol. 15, pp. 365-385 inter-temporal technology transfer" *Strategic Management Journal,* (forthcoming)

Granovetter, M. (1973). "The Strength of Weak Ties", *American Journal of Sociology,* 78: 1360-1380.

Granovetter, M. (1985). "Economic action and social structures: The problem of embeddedness", *American Journal of Sociology, vol. 91, No. 3, pp. 481-510.*

Hakansson, H. (1989). *Corporate Technological Behavior: Cooperation and Networks.* Routledge, New York.

Hirschhorn, L. (1984). *Beyond Mechanization: Work and Technology in a Postindustrial Age*. MIT Press, Cambridge, MA.

Kodama, F. (1992). "Technology fusion and the new R&D", *Harvard Business Review,* July-August, pp. 70-78.

Kogut, B. and Zander, U. (1992). "Knowledge of the firm, combinative capabilities, and the replication of technology", *Organization Science,* Vol. 3, pp. 383-397.

Lucas, H. C., *The T-Form Organization: Using Technology to Design Organizations for the 21st Century*, San Francisco: Jossey-Bass, 1996.

Malone, T., J. Yates and R. Benjamin. (1987). 'Electronic markets and electronic hierarchies', *Communications of the ACM*, **30 (6)**, pp.-.

Macneil, I. (1980). *The New Social Contract: An Inquiry into Modern Contractual Relations.* Yale University Press, New Haven.

Meyer, A., J. Goes, and G. Brooks. (1993). "Organizations Reacting to Hyperturbulence". In G.P. Huber and W.H. Glick (eds.), *Organizational Change and Redesign: Ideas and Insights for Improving Performance,* Oxford University Press, New York, pp. 66-111.

Miles, R. and C. Snow. (1986). "Organizations: New concepts for new forms", *California Management Review*, Spring, pp. 62-73.

Mukhopadhyay, T. S. Kekre and S. Kalathur, " Business Value of information Technology: A
Study of Electronic Data Interchange, *MIS Quarterly*, Vol. 19, No. 2 (June 1995), pp. 137-154

Nohria N. and R.G. Eccles (1992) *Networks and Organizations: Structure, Form and Action*, Harvard Business School Press, Boston.

Panko, R. *Business Data Communications*. Upper Saddle River, N.J.: Prentice-Hall, 1997

Powell, W. (1990) "Neither market not hierarchy: Network forms of organization" In B. Staw and L. Cummings, (eds.), *Research in Organizational Behavior,* Vol. 12, JAI Press, Greenwich, CT, pp 295-336.

Prahalad, C. K. and G. Hamel. (1990). "The core competence of the corporation", *Harvard Business Review,* May/June, pp. 79-91.

Teece, D. (1980). "Economies of the scope and the scope of the enterprise", *Journal of Economic Behavior and Organization,* 1, pp. 22 3-247.

Verifone Web pages at http://www.verifone.com

"Verifone Philosophy, The," Verifone: Redwood City, 1995.

Williamson, O. E. (1991). "Comparitive Economic Organizatgion: The analysis of discrete structural alternatives", *Administrative Science Quarterly,* 36: 269-296.

Table 1: Examples of Virtual Organizations

Kennametals is a tool manufacturing company. Faced with falling sales, the company embarked on an ambitious effort to redesign its technology infrastructure. One of its objectives was to provide better customer service; as an example, Kennametals will provide and operate the tool crib for its clients. Kennametal employees work on the customer's premises, issuing tools to employees. The customer is charged for the tool only when it is issued. Kennametals owns and manages the tool crib; it provides a virtual tool inventory for clients (Lucas, 1996).

Chrysler has adopted just-in-time (JIT) production that is enabled by EDI (Electronic Data Interchange). Chrysler keeps a raw materials and assembled products inventory of a day's production or less. It coordinates with suppliers using electronic communications; suppliers receive information on what assemblies must be at a particular location on the assembly line at a specified date and time. It is estimated that Chrysler has driven more than $1 billion in inventory from its manufacturing system, relying instead on a virtual inventory maintained by suppliers (Mukhopadhyay et al. 1996, Lucas, 1996). (It is quite likely that the suppliers' inventory is also virtual as they follow just-in-time practices.)

Ford designed a new "city car," the Ka, and convinced parts suppliers to fund some of the costs for developing parts. At its Valencia, Spain factory, Ford has provided land to parts suppliers, fourteen of whom have built factories next to Ford's. As the Ka moves down the assembly line, pre-assembled components from the parts manufacturers arrive on overhead conveyers from the parts factories. The assemblies are placed in the shell of the car, frequently by robots (New York Times, January 15, 1997). Ford has formed an alliance with its virtual suppliers that can be characterized as highly interdependent. This alliance is likely to be long-term given the physical proximity and linking of manufacturing plants.

Calyx and Carolla, a West Coast floral firm, is an example of how one can "snap" virtual components together to create a firm. Ruth Owades, the founder of Calyx and Carolla, saw an opportunity to dramatically reduce cycle times in the flower business. Instead of growers selling in bulk to distributors who in turn supply retail florists, Owades vision was to have growers pick, arrange and pack flowers for distribution by an overnight carrier. The customer would receive flowers 24 hours after they were cut. Owades had to convince growers to package individual shipments when they were accustomed to bulk shipping. Some growers had to hire extra help to arrange flowers and pack them. Owades had to experiment to see if the flowers would survive shipping by an overnight carrier. Finally, she convinced Federal Express to be her medium for delivery.

The real part of Calyx and Carolla is an office and warehouse (for dried arrangements) in Burlingame, California. There employees take orders over 800 numbers for delivery as soon as the next day. Growers are virtual suppliers of the goods Calyx and Carolla sells. Visa, Mastercard and American Express are a virtual accounts receivable department, and Federal Express is a virtual delivery department. Calyx and Carolla coordinates all of these virtual components using a variety of technologies including e-mail, fax, and telephone (Lucas, 1996).

Table 2: VeriFone's Philosophy

VeriFone publishes a booklet on its philosophy in seven languages. Below are excerpts: *Philosophy: A system of motivating concepts or principles; the system of values by which one lives.*

VeriFone is committed to:

Building an Excellent Company
Meeting the Needs of Our Customers
Recognizing the Importance of Each Individual
Promoting a Team Spirit
Focusing Accountability in Everything We Do
Fostering Open Communications
Strengthening International Ties
Living and Working Ethically.

The booklet devotes a page to a further elaboration of each of these statements; another source for further information is the Verifone Web site at http://www.verifone.com.

Table 3: Examples of VeriFone Communications Media

Lowest interaction:

U.S. Mail- snail mail
Courier
Electronic Mail (addressed)
Electronic Mail (bulletin board)
Fax
Voice mail
Electronic chat 1:1
Electronic chat 1:many
One-way broadcast audio
One-way broadcast video
Store-and-forward compressed audio on demand
Audio annotation to files/e-mail
Store-and-forward compressed video on demand
One-way broadcast video w/audio back channel
Point-to-point telephone call
Point-to-point telephone call (full duplex audio conferencing)
Multi-point telephone call
Multi-point telephone call (full duplex audio conferencing)
Live Board with point-to-point audio
Live Board with multi-point audio
One-way broadcast video w/audio back channel
Point-to-point video conference (56-112 Kbytes)
Point-to-point video conference (> 112 Kbytes)
Multi-point video conference (56-112 K Bytes)
Multi-point video conference (>112 Kbytes)
Virtual Reality meeting
Face-to-Face meeting

Highest interaction

Source: Galal, et al. 1995

Table 4: Excerpts from a Daily Flash Report

"Strong operations days continued Monday. We also released the official results for July and while the PBT (Profit Before Tax) Flash was pretty accurate (unfortunately) in projecting the loss (projected loss of $3.812 M vs actual 3.969M loss), the forecast was off on the top line. July revenues were forecast at $8.228M, but actuals were $7.766M. ...

Operationally Monday we saw more than $1M booked and more than $700K shipped. In Maxcim (integrated manufacturing and inventory system) for August jumped over $793K to $10.409M and HOLD rose $186K to $3.116M. Total demand stands at $13.295M, up $967K from last Friday. Our goal remains $27.8209M compared to plan of $23.32M so you can see we still have some distance to go. We are heading in the right direction though! Let's keep it rolling for the remaining 19 days of August.

The other good piece of operational news is that gross margins at standard cost for the "In Maxcim" $10.409M moved up six tenths of a point from 59.5% to 60.1%. This is the biggest jump in quite some time and I encourage the cost accounting folks in SNA (Costa Mesa, California) to make sure we don't have any zero cost items creeping into our picture....

Top bookings Monday came from Terry Balthaser (Financial Southeast) with a very strong $421K. Second place went to Cindy Rathbun (Financial Northwest) with an also strong $121K. Third place went to Rob Meli (EMEA North) with $170K. Way to go top three!...

Four new names in the top 15 with Terry entering in third place. Cindy beginning at eight place. Rob starting at ninth place and Barbara jumping in at eleventh. Martha also moved up past one colleague. Who will make the next move?

[List of top 15 producers, their region and sales to date.]

We've 19 days remaining in August. Let's keep our momentum going! It's truly making a difference! Until tomorrow, let's keep selling!

Source: Galal, et al. 1995

Table 5: Characteristics of a Virtual Organization

Characteristic	Components
From organization to organizing	Lack of hierarchy Lack of status Minimal politics Temporary virtual task forces (cross functional)
Management culture and norms	Culture of urgency Fast response organization Trust and reciprocity Employee initiative
Information and knowledge sharing	Wide variety of communications media Electronic media for efficiency and response Significant face-to-face interaction Significant travel burden
Self-governance	Decentralized decisionmaking and initiative Responsiveness to local environment Global problem solving

APPENDIX
Interview Protocol

1. How does VeriFone differ from other, more traditional organizations? How is it different to work there than say AT&T, Microsoft, or even NYU?

2. How do you measure performance, both of your own employees and companies that are your partners as suppliers or in alliances?

3. Our impression is that a great deal of power is vested in employees at all levels of the firm. How do you empower employees? In a bureaucracy, everything is written down; each person knows what the firm wants him or her to do and the limits of their ability to make decisions. In a virtual firm, how do employees know to what extent they can exercise their own discretion and take responsibility for actions?

4. How much do you trust workers at all levels to make the right decisions? How are their decisions monitored?

5. Working with other firms as partners and in alliances means that you all have to share knowledge, for example, your alliances with other firms to help develop payment and credit verification schemes for the Internet. What mechanisms do you have for obtaining knowledge from these other firms and providing them with your knowledge about verification?

6. VeriFone looks very decentralized and distributed geographically. How do you coordinate activities around the world? How are you sure that employees in remote locations are working toward accomplishing the company's objectives?

7. In terms of market share and financial performance, VeriFone has been very successful. What do you think are your competitive advantages and how are you able to sustain them?

8. VeriFone operates in many different cultures. How do you handle the differences among them?

9. What are the reasons for entering into an alliance with another firm?

10. Do you have any other comments or observations on what makes VeriFone unique?