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Women in High Technology Enterprises

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WOMEN IN HIGH TECHNOLOGY ENTERPRISES

by

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ABSTRACT

Although women have been in the work force for time immemorial, their ability to obtain positions equal to men's have nearly always been compromised. There have been many efforts to rectify this situation, including legislation, corporate awareness, peer pressure, and individual achievements. But none has held the promise of as much transformation as the changes that are occurring in today's business world. This paper will explore whether the new business model, especially in the high technology sector, will enable women to break through the discrimination barriers of the past and compete on an equal playing field.

PURPOSE AND OVERVIEW

Although women have been in the work force for time immemorial, their ability to obtain positions equal to men's have nearly always been compromised. Whether it was through legislative action, corporate exclusion, discrimination, socialization, or societal pressure, woman have historically had a difficult time securing equal jobs with equivalent pay.

This inequality is most apparent in the world of business. Despite measures to correct it, women today are still unequally represented in the corporate world. Although they comprise 58.7 percent of the workforce, they have yet to break into the top ranks of business in significant numbers. A study released October 17, 1996 by Catalyst, a non-profit research organization, found that just one out of ten of the most senior jobs at the 500 largest U.S. companies were held by women. Narrowing the criteria to the more rarefied ranks of Chairman, CEO, President, and Executive Vice-President, the number of women dropped to 2.4 percent. 105 of the companies studied had no women corporate officers at all; of the 2500 top-earning executives, just 50 were women (Himelstein, 55).

There have been many efforts to rectify this situation, including legislation, corporate programs, peer pressure, and individual achievements. But none has held the promise of as much transformation as the changes that are occurring in today's business world. The top-down hierarchies and multilayered bureaucracies that were the standard business models of the past are being flattened to better address a business environment that is volatile and unpredictable in markets, product life cycles, competitive pressures, and technology.

No industry better depicts this changing paradigm than high technology. The majority of these enterprises are relatively new and growing, with virtually no legacy of gender discrimination and an ever growing need for personnel. It would appear that this business sector could be the environment that finally enables women to break through the discrimination barriers of the past.

This paper considers this possibility. It examines current writings regarding the historic evolution of women in business, the current business climate in the high technology sector, and how women have fared to date in this field. It also reports as a case study survey results of technology workers at a high technology company which provides their view on whether there is a parallel between occupational advancement / job enrichment and the new entrepreneurial business model.

BACKGROUND:

Historic Evolution of the Business Model

The origins of today's organizations can be traced to the emergence of industrialization, which transformed what had been largely a rural and agricultural economy into one that was urban and based on group process and production. The inherent complexity of this model and the change in work environment from autonomy to dependence upon others soon necessitated methodologies to ensure productivity and the effectiveness of personnel. Hence the concept of organizational structure was born (Bedeian, 44).

Early proponents included Henry R. Towne (1844-1924), who advocated industrial management as a disciplined field of study; Frederick W. Taylor (1856-1915), who viewed it as a science with clearly stated rules, laws, and principles; and Henri Fayol (1841-1925), who classified management into functional areas (planning, organizing, coordinating, commanding, and controlling), and developed the principles of "division of work," and "span of control" (Bedeian, 45-47). But none had as great an effect on the developing business model as German Sociologist Max Weber (1864-1920).

Where previous efforts had been directed at the practical problems of organizing as a means of effectively accomplishing goals, Weber focused on developing systematic requirements for the organization. His "bureaucratic model," which he described as "the most efficient and rational means of organization" because of its "stability and reliability, calculability of results, and wide applicability" (Bedeian, 50), institutionalized hierarchical power. There was a clear division of labor. Top management was responsible for eliciting compliance. Work activities had a defined set of criteria: jobs had formalized descriptions. Rules and procedures were spelled out, with penalties for poor performance and rewards for achievement (Fischer, 107-119).

Bureaucracy soon became the predominant form of organization structure. Its effectiveness was heightened during the periods of rapid growth and high demand for goods and services. Because the standard, pyramidal organization could be scaled, when a company needed to grow, it could simply add workers at the bottom of the chart and fill in the management layers above as required. During periods of decline, it could be pared in the same way.

Because work could be broken down into pieces, the structure was ideally suited for planning and control. Supervisors could ensure consistent and accurate work performance. Training could be accelerated because few production tasks were complicated or difficult. Budgets could be easily approved and monitored by department; plans could be generated and pursued on the same basis (Hammer, 16).

This model continued relatively unchanged until the end of the Second World War, when, as a result of the "overwhelming economic superiority" brought about by the Allies victory, American businesses began to invest heavily abroad (Bluestone, 112-113). Although initially these investments served to enhance the earnings of U.S. enterprises, the technology that was shared, the joint production that was initiated, and the overall strengthening of the country's economy by American companies began more and more to benefit foreign markets (Bluestone,142). What ultimately resulted were strong competitive foreign enterprises which began to compete formidably on a global level.

Intensifying this situation were the rapid advances in computer and communication technology. As a result of computer proliferation, information became readily and easily accessible. Product life cycles were dramatically abbreviated. Organization could enter into new markets in greatly accelerated timeframes. What once took thirty years to get from pure research to commercial application was reduced 33-50%. (Applegate, 129).

The effectiveness of the old bureaucratic model began to erode. Facing a substantial drop in business activity during the recession of the early 1980s, enterprises found they had to change to survive. Many followed the traditional pattern by cutting employees from the bottom up. But what had worked in the past was no longer effective -- companies found themselves experiencing a reduction in competitiveness. Morale and loyalty began to slump; key employees began to defect. Customers began to react negatively to the poor service and quality that ensued (D. Mills,15).

A few innovative firms, sensing that the problem was too many middle tier personnel who, because of applied technologies, had become non-essential, began to pare personnel from these roles. The results for many companies were striking. Costs reduced and competitiveness began to be restored (D. Mills, 16).

What these companies had moved into can be described as the "new enterprise," a shift from the multilayered hierarchy (or the traditional bureaucracy) to flatter networks or relatively autonomous businesses. The professional, not the manager, became the central player -- often working in a multidisciplary team that cut across traditional organizational boundaries. Interpersonal commitment, rather than traditional reward and punishment mechanisms, became the basis for organizational cohesion and stability. The resource focus shifted from capital to human and information resources. These changes can be described as a more "information age" or " open network" structure, transcending from the older model in the following ways (Tapscott, 11-12):

	Bureaucratic Organization	**Open Networked Organization**
Structure	Hierarchical	Networked
Scope	Internal/closed	External/open
Resource Focus	Capital	Human, information
State	Static, stable	Dynamic, changing
Personnel/Focus	Managers	Professionals
Key Drivers	Reward and punishment	Commitment
Direction	Management commands	Self-management
Basis of Action	Control	Empowerment to act
Motivation	Satisfy supervisors	Achieve team goals
Learning	Specific skills	Broader competencies
Compensation	Position in hierarchy	Accomplishment, Competence
Relationships	Competitive	Cooperative
Employer attitude	Detachment	Identification
Requirements	Sound Management	Leadership

In this new model, the enterprise shifted from a multilayered hierarchy to a flatter network, with the business team the key organizational entity rather than the defined department represented within the traditional organization chart. The organization expanded to include links with external business partners -- suppliers and customers. The resource focus shifted from capital to human and information resources. Rather than remaining static and stable, the enterprise became dynamic and constantly changing. The professional, not the manager, emerged as the central player. Interpersonal commitment, rather than traditional reward and punishment mechanisms, became the desired basis for organizational cohesion and stability (Tapscott, 12).

Historic Evolution of the Gender Model

The basis for today's gender structure can also be traced to the emergence of industrial capitalism, which transformed the feudal home and hamlet into workshops and then factories. In Agrarian times, both husband and wife jointly worked in productive activities. Women's responsibilities were domestic -- as the direct producers of primary resources (gardening, keeping game, etc.); in processing and storing farm produce (Gerstel, 31); and in outfitting the family, cooking, cleaning, and caring for children, the sick and the elderly. Men's tasks involved wood and leather and the more physically demanding aspects of farmwork. Both men and women produced goods that were intended for sale in the market economy (Gerstel, 165-66).

But the emergence of the Industrial Age in the late 1600's changed this pattern of domestic life. Disconnecting the job site and the household led to equating "work" with "paid employment," and, as the traditional roles of both men and women got replaced by new machinery, men reskilled and became the production workers, while women, still tied to their domestic responsibilities, assumed the rest of the workload in the home.

By the late 1830s, a concept of masculinity began to permeate the working class (Cockburn, 77-8). An ideology developed that defined being a wife and mother as an end in itself. Women were to be nurturing, religious, self-abnegating, and demure. A woman's place was in the home; man's was in the business world (Gerstel, 154-55). Although single women were allowed to partake in the work force if their wages were needed to supplement the family economy, they were expected to leave as soon as they were married. (Gerstel, 169).

Between 1890 and 1910, the large corporation emerged as the dominant business form. Women began to enter this domain, but never in positions of significance or power. Their primary role was within the office to handle the growing requirement of dealing with paperwork (Kanter, Change, 18).

As organization size continued to increase, and modern administrative policies and practices developed in the areas of labor recruitment, disciplined work schedules, and customer relations, the concept of professional managers emerged, defined as one with "a tough minded approach to problems, analytic abilities to abstract and plan, a capacity to set aside personal and emotional considerations in the interest of task accomplishment, and a cognitive superiority in problem-solving and decision-making" (Kanter, Change, 22-23). This "spirit of managerialism" was "characterized as masculine" (Kanter, Change, 20). Patriarchy became etched into the corporate model. This was further exacerbated through an education system that by systematically differentiating between the sexes excluded women from professional, bureaucratic, and political positions (Gerstel, 37).

Although there were some periods of change, they were only temporary. During the First and Second World Wars, when men were unavailable to fill the burgeoning employment roles, women were encouraged to assume these positions. The federal government even established work training programs in industrial skills and authorized federally supported child day care. But as each war ended, these programs were dismantled and women found themselves "rapidly swept out when the forces returned home" (Cockburn, 79).

Yet the slow, consistent upward creep in the labor force participation of women did occur, spurred to a large extent by the demand for certain types of labor (Gerstel, 50).

Women emerged as dominant in certain occupations including nursing, which developed as an ancillary occupation in support of physicians (Stromberg, 208-9); teaching, which in the 1850's transcended from a temporary or last-choice job for men to a profession for "well-educated and dedicated women" (Stromberg, 214); librarianship, which also transformed from a man's field in the early decades of the nineteenth century to one in which women could "exercise their sphere of culture, moral uplift and education" (Stromberg, 218); the service sector, which has become more female dominated as more and more men were moved into management (Gerstel, 48); and clerical work, which, by 1985 had grown to such gender disparity that 96 percent of all typists, 99 percent of all secretaries, 94 percent of all bank tellers, and 97 percent of all receptionists were women (Stromberg, 226-7). It was married women, especially those with children, that were the primary source of this growth.Whereas in 1890 the majority of working women were young and unmarried, by 1986 58% were married (Reskin, 9).

Legislation also helped to improve opportunities for women, including the Civil Rights Act of 1964, which made it illegal to discriminate on the basis of race, color, religion, sex, or national origin; the Pregnancy Discrimination Act of 1978, which made it illegal to discrimination on the basis of conditions related to pregnancy; and the Family and Medical leave Act of 1993, which required that employers with staffs of 50 or more grant up to 12 weeks of unpaid leave annually for the birth or adoption of a child (Auster 357). Other legislation has been adopted to prohibit sexual harassment and provide for equal pay (Stromberg, 337-8).

Women in Business Today

Over the years, there have been many changes in the role of women in business. A good illustration is an enterprise study conducted by Rosabeth Moss Kanter in 1977. This Fortune 500 multinational, termed Industrial Supply to maintain its anonymity, was, at the time of her research, one of the world's largest producers of industrial goods. It was a complex, bureaucratic organization, with 50,000 employees, of which 16% were women (Kanter, Men," 30). Few of the women held jobs of stature. To illustrate: all jobs were given numeric grades; jobs with management responsibility began at Grade 9, officers began at Grade 20. The number of women with positions above Grade 10 were in the "single digits" (Kanter, Men, 37).

Success at Industrial Supply was defined by ones upward mobility into management. The appropriate pathway was to hold a variety of increasingly responsible positions across multiple functions, each for two or three years, coupled with a period of service at corporate headquarters (Kanter, Men, 129-30). But such mobility was difficult for a woman to achieve. Management functioned as a closed circle, and moving into it was easier for those with "homogeneity in class, ethnic background, and social experience" (Kanter, Men, 53).

The few women that did manage to move into non-traditional positions often found themselves in situations where they were regarded as "tokens." Although such categorization can sometimes serve to create visibility, an important element in a "system where success is tied to becoming known," it more often develops as a result of discrepant characteristics rather than personal achievement (Kanter, Men, 216). At Industrial Supply, the phenomenon of being an outsider resulted in women having a much higher failure rate, especially in sales where the it was double that of their male counterparts (Kanter, Men, 207).

In 1993, Rosabeth Moss Kanter returned to Industrial Supply Company to analyze how the organization had developed since her initial study. What she found was that "macroforces" outside the boundaries of the corporation had dramatically affected its operations and structure. It had become leaner and more horizontal, resulting in a more diverse workforce and a greater emphasis on project teams which served to bypass the old vertical hierarchies (Kanter, Men, 290). Although the company still had much to achieve in terms of equal employment, it was a vastly different environment than had existed sixteen years earlier.

Much of the change had to do with the spirit of entrepreneaurialism and the effects of a global economy. Both forces served to successfully erode the preeminence of the company as an "old Industrial giant," and dramatically alter the way it was structured.

It no longer had the distinction as being the "role model of the best practices" nor "representative of America's industrial might" (Kanter, Men, 295). Taking its place were foreign companies that operated with greater technologically sophistication and resilience, and newer, higher-technology firms that operated with greater entrepreneurial vigor.

The Entrepreneurial Business Model

Entrepreneurial companies have adopted a more open and networked structure, less defined by the old model of command and control. As a result, they have greater flexibility and agility to develop products, enter new markets, and form unconventional alliances to gain market share. (Kanter, Men, 299).

Unlike the traditional hierarchy/matrix organizational form, high technology companies have fewer layers of management and less bureaucracy. In general, people have a chance to get involved in a broader range of responsibilities and, as a result, have a better understanding of the business as a whole. Leadership and control follow a model in which top management can communicate directly with workers and therefore can readily trace individual contributions (Applegate, 132).

Because of these business dynamics, talented personnel are always in demand. According to the U.S. Department of Labor, computer scientists and systems analysts, for example, are two of the four fastest growing occupational categories and among those commanding

the highest in pay. A recent issue of Business Week described the recruiting effort for qualified high technology talent as a "bidding war" as a result of soaring demand (Baker, 36).

Because high technology businesses tend to have more diverse workforces with a higher mix of minority personnel, many believe that they provide greater opportunities for women. They generally are younger and not as tradition bound nor steeped in male-dominated hierarchy as their predecessors. Knowledge is the highest valued commodity for the worker.

Summary

The changes that have affected business since the industrial revolution have been profound, transforming what was a well defined and highly structured bureaucratic model into a more open and networked structure. As a result of macroforces outside of the corporation's control, such as globalization, entrepreneuralism, and rapid advances in computer and communication technology, enterprises found themselves in a highly competitive and fast moving business climate, and most had to redefine and restructure to survive. This new business model also had a profound effect on the employee base, and with knowledge and talent replacing position and stature as the characteristics of value, caused the gender stereotyping and systematic exclusion that women had been subjected to since the industrial revolution to erode.

HIGH TECHNOLOGY BUSINESS

The new entrepreneurial business model, which is based on teamwork, better quality, improved service, faster time to market, and an organization structured around product/customer focused units with minimal management layers, evolved in a large part as a result of the emergence of the high technology sector. It was this sector that served to transform the focus of business away from machinery and equipment to intellectual capital (essentially ideas and talents), and helped create a world in which electronic highways enable instant communication and rapid response, and work involves the creation, transmission, and manipulation of information and knowledge. It has also had a dramatic effect on employment, generating a virtually limitless number of jobs and heightened opportunities for employees of either gender.

What Is High Technology? How Does it Differ from the Old Business Model?

The high technology sector has been defined as industries which include the following Standard Industrial Codes: Computer and Office Equipment (SIC 357); Communications Equipment (SIC 366); Electronic Components and Accessories (SIC 367); Guided Missiles and Space Vehicles and Parts (SIC 376); Instruments (SIC 38); and Computer Programming and Data Processing (SIC 737) (Saxenian, 209). These categories all share special characteristics which include product lines with short life cycles; long development cycles; the need for extensive research and development which involves advanced technology; and the employment of scientists and large numbers of other individuals who are motivated by innovation and curiosity (Defining, 1). High

Technology companies have special capital requirements, and are more investment and future oriented that other types of enterprises (Kanter, Change, 50).

High technology is an industry that repeatedly "swaps out its own infrastructure," in that by continually striving for better functionality and price performance, new releases usually make the offerings that preceded them obsolete. Virtually all of the sector's products rely heavily on software, which too must remain compatible with the current development level. Because of the short life cycles, each change generates massive new influxes of spending and the introduction of new players in the marketplace, causing the sector to experience fierce economic competition (Moore, 6-7).

High Technology is an industry that doesn't only react to chaos; it produces it. Long term planning is not one of its characteristics. Three years is considered lenghtly; anything more has been termed "laughable" (Prokesch, 137). These short windows of opportunity create an industry that is extremely dynamic and usually involved in numerous simultaneous initiatives (Geoff, 2).

High Technology has been described as the third Industrial or Information Revolution because it has caused sweeping societal transformation comparable to the First Industrial Revolution of the mid-18th Century, in which people, driven by new mechanized processes, left the farm for the city's factories. It has also been compared to the Second Industrial Revolution of the late 19th Century, when a new wave of innovations such as

electricity and the automobile further bolstered the emerging white collar worker and further transformed their lives (Mandel, 58-61).

High Technology proliferated during the mid-1970s when the price of computing power began to plummet, and experienced accelerated growth during the recession of the early 1980s (Goldberg, 1) when it was determined that the information gathering and decision making capabilities of the computer could replace the communication, coordination, and control functions that had previously been performed by middle management (Applegate, 129).

Although during the period 1983 to 1993 high technology spending in dollar terms was comparable to the rest of the economy, since that time it has skyrocketed while the rest of the economy has slowed down (Mandel, 61). From 1994 to 1997, the high technology sector has contributed 27% of the growth in gross domestic product (GDP), representing 33% or $420 billion. It now employs more than nine million workers, representing 20-25% of the growth in real wages and incomes. Consumer and business spending on information technology hardware has also grown, representing $282 billion in 1996, which is 17% more than U.S. purchases of new motor vehicles and parts; 49% more than spending on new homes; and 168% more than commercial and industrial construction (Mandel, 58-68).

Where the Industrial Age represented concentration of power (Mass Markets; Large Factories; Big Government), the Information Age has de-massified everything. Majority rule has given way to minority power. Mass markets have splintered into niches (Pritchell, 47). Because most high technology companies began as either startups -- that is entirely new companies founded around a core product or idea -- or a spin-off / autonomous subsidiary of an established company that operated relatively unconstrained by its parent, most developed and grew without the old ideas of hierarchical command and control. Some key distinctions can be seen in the following comparison of the six predominant cultural philosophies have guided the development of corporate culture during the past 150 years:

Traditional Companies

- **Business = Battlefield**: Business strategies and tactics are described and executed in military terms, e.g. giving the troops their marching orders. This type of thinking engenders a structured organization with well defined positions and roles.
- **Corporation = Machine:** A corporation is considered a system in which no employee is indispensable. Individual initiatives, goals and desires are completely subsumed by the demands of the corporate machine. The result is a rigid organization with well defined roles and functions.

High Technology Companies

- **Business = Ecosystem**: Business is viewed as a set of symbiotic relationships, in which diversity is a key element for success. The result are companies with diverse employee bases that are structured to adapt quickly to new market conditions.
- **Corporation = Community:** A company is considered a collection of individuals with distinct hopes and dreams that are connected to their organization's purpose. The result is an employee base that seeks to excel, not out of fear or obligation but because of the satisfaction derived by contributing to one's own success, the success of one's peers, and the community at large.

• **Management = Control:** The real job of a manager is to control employees behavior so that they do what management wants. Employees who disagree or do not conform are considered dangerous and insubordinate. The result is a company with a conflicting power structure in which factions vie for control.	• **Management = Service:** A manager's job is to set direction, to lead rather than mandate actions. The result is that decisions are allowed take place at much lower levels in the company among teams that can adapt to market conditions without being constrained by corporate edicts.
• **Employee = Child:** Employees are considered too immature to be trusted with real authority. They are viewed as needing complicated rules and regulations in order to do their jobs. The result is employees are reluctant to do anything until they are certain they won't be held responsible if something goes wrong. Of ten they spend more time protecting their reputations than doing productive work.	• **Employee = Peer:** Every employees is considered the most important person in the company. Excellence is expected and encouraged everywhere. Mistakes are viewed as situations for learning. The result is that employees at all levels are willing to take responsibility within a spirit of friendly competition..
• **Motivation = Fear:** Employees put in the effort because of fear -- of getting fired, losing privileges, etc. Managers capitalize on this fear as a means of motivation. The result is that employees and managers become paralyzed, unable to make risky decisions or take courageous actions. Work becomes filled with corporate politicking.	• **Motivation = Vision:** People know where they are going, so the process of work is filled with energy and enthusiasm. The result is employees who believe in the company's goals and derive greater pleasure from their jobs. This is reinforced through compensating programs that often include achievement bonuses, profit sharing or stock options.
• **Change = Pain:** Change is viewed complicated and difficult, something to be undertaken only if the situation is desperate. The result is that attempts to effect change, through programs such a reeingineering or restructuring, usually fail because of resistance or avoidance of change.	• **Change = Growth:** Change is viewed as positive because it is part of adapting to new market conditions and growing into new levels of success. The result is both employees and the organization embrace new ideas, new ways of doing business, and new ways of making profits.

(Geoffrey, 63-73).

Most high technology enterprises have adopted these characteristics because the dynamics of the industry dictate the need to readjust continually to change. They make heavy use of rapidly shifting project teams and decentralized networks of relatively autonomous entrepreneurial groups; people communicate laterally throughout the organization to manage interdependencies in projects without much reliance on traditional hierarchical decision making process" (Bradley, 142).

Why Did It Grow/Why Is It Growing Still?

America's high technology industry sector has become one of the central engines driving U.S. economic growth -- the source of thousands of new businesses, millions of high-paying jobs, and fast creative opportunities (De Bare, 1). This growth continues to be spurred by three very distinct business phenomenon:

- **The need for enterprise-wide information systems**: Most traditional enterprises developed their information networks in a departmental fashion, acquiring computer technology appropriate for a specific part of the organization. But with the tremendous changes that have occurred in the business world -- globalization, intensified competition, reduced time to market, mandated regulation and deregulation -- the need to better utilize digitized information has become imperative.

The growth of the high technology sector has been to a large part driven by the needs of businesses to link their disparate computers and applications in such a way that they can be used to monitor information "real-time" and to make strategic business decisions. With the movement towards a more collaborative business model, there is also the need for businesses to use their computer networks for forging direct links to suppliers and customers and for stringing together such operations into common systems (Baker, 36-37).

- **The Year 2000**: The propagation of computers has also caused a technical ramification regarding the way dates are handled in many traditional application programs. The fact is that a large number of business programs -- those used, for example, to issue paychecks, calculate life-insurance premiums, etc. -- are not set up to work with dates after 1999, requiring these applications to either be replaced or reprogrammed. This is causing a surge in the purchase of new computers and applications, and the employment of large numbers of consultants and specialists. Industry experts have estimated the cost for fixing the problem worldwide will range in cost from $400 to $600 billion, and will require as many as 200,000 additional specialized programmers (Year 2000, 1).

- **The Internet**: The Internet is a dynamic new way to disseminate and retrieve information; conduct market research; communicate with virtually anyone, anywhere; educate consumers, and sell products and services. It consists of two components: the Internet, which is a collection of server computers that enable information to be accessed by the general public, and Intranet, server computers that physically reside within an enterprise and provide access to internal information only to those authorized. The near universal adoption of this technology within all segments of society have spurred a new emerging industry of Internet-related companies, as well as the adaptation of products to the Internet environment itself. Its future looks virtually limitless.

These three phenomena, coupled with changes in the business world itself, including deregulation, the threat of corporate takeovers, and the rise in shareholder activism, has caused enterprises to take aggressive action to secure market positions, increase earnings, and push up stock prices. The utilization of high technology is vital in these efforts (Annable, 18). As a result, the high technology industry has an almost limitless number of jobs with highly competitive salaries and benefits and not enough qualified people to fill them. Whereas the U. S. Department of Labor classifies computer scientist and systems analyst as two of the top four fastest-growing categories of jobs between now and 2005 (De Bare. 1), administrators at university computer science departments in many areas of the U.S. today report they have only enough graduates to fill about 70% of the currently available positions (Didio, 1).

Employment Needs of High Technology Companies

As a result of this accelerated adoption of high technology and its seemingly limitless growth, there is a burgeoning need for staff . A 1997 study by the Information Technology Association of America (ITAA) estimates that 190,000 information and technology jobs in U.S. companies are currently vacant. This dearth of employees has resulted in a "bidding war" for digital talent (Baker, 36). Help wanted ads "plead for project managers, systems analysts, and help-desk technicians." In addition, the operation and modification of computer systems have created a bull market for the management consulting industry, which is adding jobs at a rate of more than 40,000 per year (Mandel, 61).

There are some definite characteristics and attributes high technology companies look for in their employees, primarily the ability to not be threatened by a changing environment (Prokesch 142). The optimal employee is described as something of a "maverick" -- ambitious, "able to operate outside of the status quo and ride the rocky road to change" (Godlberg 29-30). Individuals who are "highly focused" have grea' 'ceed (Frenkel 3). What counts most are attention to detail; patience; th der pressure; a capacity to both work alone and with others adaptabilit , commitment, and persistence (Goldberg 30-31)

Because the history of high technology is one of rapid successes and even faster failures, the most critical attribute one can bring to a career in the technology industry is flexibility and a tolerance for risk. Things change so rapidly, new opportunities open faster than in older lines of work (Russell, 55). In the high technology industry, there is generally less concern about age, gender, or race, and more mobility because there is rarely someone with many years experience in line for a promotion Lifelong learning is vital. High technology employees are expected to grow (Russell, 55).

Women in High Technology:

Why High Technology Should Have Been a Good Arena for Women:

The origins of the high technology sector actually began as a result of women's efforts. During the 1940s, amid the Second World War, the Army established a facility in Philadelphia, Pa. and employed a group of women, who they called "computers," to calculate trajectories and help wartime artillery gunners take aim. The jobs were classified as clerical work, and women were chosen rather than men because they were believed to possess "the patience for such tedium"-- a single problem might require months of work. What emerged out of these early efforts was the genesis for a new industry. To accelerate the calculations, a new machine called the Electronic Numerical Integrator and Computer (ENIAC) was developed, whose operation required setting dozens of dials and plugging a ganglia of heavy black cables into its face, a different

configuration for each problem. Women again were employed for this function, both because of their tenacity as well as their perceived agility. The new task was described as "programming" (Petzinger, 1).

It was not long before the industry burgeoned and so did demand for employees. It appeared that women characteristically paralleled its needs. Studies have shown:

- Women tend to be more verbal and articulate, mastering languages and professional terminology faster (Goldberg, 48). They also rate higher in verbalizing ideas, important in computer fields where most work involves the manipulation of information and communication with people and relies as much on verbal and interpersonal skills as on mathematical abilities (Cottrell, 2).

- Women tend to be more compassionate, putting themselves more readily in the shoes of others. This people orientation is important in many aspects of high technology, where the needs of the "user" are of high concern (Goldberg, 48).

- Women tend to pay greater attention to detail (Goldberg 31). This ability to ignore extraneous factors and concentrate on the task at hand is an important characteristic in occupations like programming, systems analysis, engineering, and data base design (Wright, 276).

- Women demonstrate greater company loyalty, an important element in a volatile industry. Data published by the Bureau of Labor Statistics (BLS) show that job tenure among female employees overall actually increased between 1991 and 1996, rising from 3.2 to 3.5 years; men, on the other hand experienced decreases in every age group, with the most pronounced from 1.4 to 1.2 for men in the 20-34 age group and from 3.1 to 3.0 for men between 25 and 34 (BLS, 3).

- Women tend to be more creative about problem-solving, focusing on the particulars rather than seeking a general rule, an optimal technique for high technology situations. In addition, women excel at screening out irrelevancies and working under pressure, both vital high technology requirements (Goldberg, 48).

- Women tend to be more interactive, a characteristic of leadership that is needed in the team structure of high technology corporations today (Nichols, 5).

- Women tend to be good team players and better listeners: This is important in the collaborative business model utilized by most companies in the high-technology sector (Goldberg, 48).

- Women have demonstrated that they can work well with people. This is a vital requisite in positions such as systems analyst, in which the system being developed requires an understanding of end user needs, making it "much more dependent on people than upon machines" (Reskin, 177).

- Women tend to excel at linear logic. This is highly desirable for computer programming, which in itself does not require spatial ability, and some areas of computer science, such as user interface design, which requires more knowledge of human psychology than mathematics (Spertus, 1).

- Women's have superior fine motor skills. The advantages of this characteristic in high technology are well documented. They were first identified by the Army in the 1940s (Goldberg, 48).

- Women tend to be global thinkers: Being able to look at the larger picture and persists is important in the changing arena of high technology (Goldberg, 48).

- Women are well educated: In 1995, 23% of working women age 22 to 34 years had bachelors degrees compared with just 20% of working men. What's more, the National Center for Education Statistics projects that women will earn 55% of all bachelors degrees over the next decade. The fact that many of these degrees are not technical is not a detriment; many high technology senior managers today grew from positions in sales, marketing, and finance (An Education Edge, 20).

How Women Have Actually Fared in High Technology

It was believed that women involved in high technology businesses would do better than those in other business sectors. They seemed to have the characteristics desired by companies in this sector. The "roller-coaster volatility" that characterizes this highly competitive industry should have rendered tradition a luxury and seniority systems obsolete within even the largest companies (Russell, 56). High technology, after all, is a relatively new industry with no centuries-long legacy of sexism to overcome.

However, this has not been the case. By 1992, women made up just 35% of the workforce in the computer and data processing services and only 37% in hardware manufacturing (Didio, 1). This compares to 59% in financial, insurance and real estate and over 50% in law, accounting and retail (Fryer, 52).

Women are also starkly underrepresented in top management posts and key technology jobs. Not one of the 50 biggest computer companies traded on the stock market has a female chief executive. As late as 1993, only 10.6% of the top tier executives at computer companies in the Fortune 500 were women compared to 11.1% in non-computer companies. Even in high technology, women have had to demonstrate more strengths and fewer deficiencies to be seen as equal to their male colleagues (Burke, 1093). In fact according to the Equal Employment Opportunity Commission and Census of Manufacturing, data high-technology industries were more segregated by sex in 1973 and 1982 than traditional industries (Stearns, 291).

Inhibitors to Women's Growth in High Technology

There seems to be four areas that have constrained women's opportunities within the high technology sector. These include:

- **Corporate Culture:** Despite the fact that high technology businesses developed organizational structures that were different from the industries that preceded them, in many instances the old male dominated stereotypes and legacies continued to inhibit women's growth. Many organizations still maintain a preference for being guided by the past (Kanter, Change, 50), especially in the area of gender. For many enterprises a corporate culture prevails that perpetuates male defined characteristics and patterns of behavior as preferable.

Corporate culture can be defined as "the pattern of basic assumptions that a given company has invented, discovered or developed in learning to cope with its problems of external adaptation and internal integration." Organizational culture occurs when "... individuals interacting with each other build up a fund of mutual knowledge, which is largely tacit and embodied in the institution: that is, shared rules of conduct, social structures, patterns of relationships, procedures, routines, habits, rituals, and myths" (Moorehead, 493). The culture of a firm is its customary and traditional way of thinking and doing things which is shared to a greater or lesser degree by all

members and which new members must learn and at least partially accept in order to be accepted into the services of the firm. Organizational cultures frequently include past events and which provide a hindrance to new entrants (Bradley, 140-48).

Corporate culture can be very exclusionary. There are many traditional "male-bonding rituals," such as doing business and making deals in the men's room, during card games, while playing golf or on fishing expeditions (Didio, 84). Another example is the use of euphemisms that are traditionally male. Much of the working world's vocabulary falls into three subject categories: military derivations, i.e. flagship, officer, brass, strategy, tactics; sports lingo, i.e. coach, end run, tackle the job, score, team player; and locker room language/sexual allusions (Reardon, 5).

Because management has been the most pronounced user of such jargon, having patterned its functions after the most sophisticated traditionally male symbol of all -- football (Harragan, 97-113), deeply embedded in many enterprises is the analogy of "manager" with "male." This has been perpetuated since the inception of the managerial class in the early 1900s, in which women historically were viewed as "unfit" or "too emotional" for the role (Nichols, 3); it was believed they lacked the tough mindedness, the assertiveness, the confidence, the ambition, and the ability to set aside personal and emotional considerations in the interest of the job (Spertus, 1). A recent survey found that this bias still prevails today, not only among men but also among women; the preference for male managers among the respondents was 54% to

22% among women, a rate higher than the 37% to 17% for men (Nichols, 3). These impressions are further enhanced by the business press. A recent study by the Freedom Forum Media Students Center found that women were quoted or referenced in only 13 to 14% of today's business stories (Women in Science, 1).

- **Negative Images Conveyed by the High Technology Industry Itself:** This preference for male euphemisms exists in high technology jargon as well. The predominant themes of recreational computer games are war, battles, crimes, destruction, and traditionally male-oriented sports and hobbies (Pearl, 3). These games "tend to be designed by boys, for boys" and have "stereotypical masculine values" that are "powerfully reinforced" (Wright, 275).

Although the youth of the industry offers limitless opportunities for creativity and advancement, in some cases it can also foster a kind of "frat-house" atmosphere that is less than comfortable for many women. Because of the industry's rapid product development cycles and profusion of struggling start-up companies, high technology places many demands on its people. Long hours, sometimes as great as sixty hours a week, are not uncommon. These work demands and last minute crunches can be particularly draining for women who often continue to bear most of the responsibility for raising children and getting dinner on the table (Sacramento Bee, 3). Many women are turned off by the "swagger of technojocks," where staying awake for three days to perfect a piece of software is seen as a test of virility" (Fryer, 60). The fast pace of

technological change, where new generations of microchips turn the industry upside-down every 18 months -- makes it harder for women to stay on a fast track if they take any kind of extended family leave (De Bare, 4).

Another negative women find in high technology occupations is the derogatory connotation some positions convey. People in highly technical jobs are often referred to as "nerds" or "geeks," an image that contributes to the scarcity of woman entrants in the industry. Another deterrent is the false image that the industry only needs those who are good at math, when in fact high technology needs a wide variety of people who are creative, think clearly, and communicate well (Cunningham, 15).

- **Gender Differences:** These include:
    - **Relationships:** Women are more likely to feel that relationships matter, whereas men seem to pay a little less attention to the quality of the relationship and choose strategies based on other factors (Deal, 69). In a survey of more than 500 women, the respondents nearly universally stated that they defined themselves primarily through relationships to others. In addition, women connect by sharing their experiences (Noble, 6). Female executives like feedback, brainstorming and sharing ideas among people they trust; most male executives don't have the same need (Leighton, 2).

Communication: Because men have previously held positions of power, they have already established male-style interaction as the norm (Tanner, 23-24). Thus, women are frequently seen as displaying too much or too little of a male preferred behavior (Reardon, 7). One example is humor, which has been found to be used less effectively by women than by men (Fisher, 220). Another is assertiveness, which for women is frequently misinterpreted, especially by males. This was illustrated in a recent study which found that a competent, assertive female leader elicited overall more negative responses than an equally competent male, but when the data were adjusted by gender, the women subjects were more positive than the males toward the female leader while the male subjects were more positive than the females toward the male leader (Butler, 52-3).

It has also been stated that communication differences may not only be a workplace phenomenon. The difference in verbal language between men and women has been explored by many contemporary authors. The popular book Men are from Mars, Women are from Venus by John Gray argues that male-female communication problems originate in men's and women's different values; Martians value and power, Venusians love (Noble, 6).

- **Professional Behavior**: Women's standards of professional behavior are frequently inconsistent with that of their male colleagues. Men and women view self-promotion differently. Males make greater use of superlatives involving social comparisons or competition; women make positive statements about how things went or how much effort was expended. Women are generally more hesitant to emphasize that they are the best or better than others (Reardon, 7); their "boasts" tend to be understated compared to males. Men are less likely to ask questions in a public situation when asking will reveal that they lack the knowledge (Reardon, 26). Although factors affecting decision making are the same for men and women and every individual has his or her own style, women are more likely to downplay their certainty, men their doubts. Men feel that asking for directions put them in a one-down position (Tanner, 24).

- **Leadership:** Men and women use very different styles of leadership. Men prefer a command and control style in dealing with subordinates -- relying on orders, appeals to self-interest, rational decision making and rewards. Women prefer to work interactively, sharing power and information, motivating by appeals to organizational goals and promoting empowerment. Women, the theory goes, are intuitive, antihierarchical, process oriented, tolerant of

ambiguity, and non-invested in power; they think in webs of many factors, not in straight lines. Men, by contrast, are logical, hierarchical, goal oriented, intolerant of ambiguity, and interested in power for power's sake (Noble, 6).

Men describe themselves in ways that characterize "transactional leadership." They see their jobs as a series of transactions with subordinates in which rewards are exchanged for services. Women describe themselves in ways that characterize transformational leadership. They encourage subordinates to transcend from their own self interests to the interest of the group through concern for the broader goal. Women tend to share power and information, encourage participation, enhance other people's self worth, and get others excited about their work. Women leaders tend to be "interactive" in their relationship with subordinates (Rosener, 122).

These differences also influence the views of men and women as to what it takes to make a successful senior manager. Men in senior management generally look for communications skills and integrity when hiring others at this level. In contrast, women look for team building skills in addition to integrity. Similarly, there are differences in what men and women identify as barriers to success for senior management. Men look at the inability to meet business objectives, while women focus on indecisiveness (Raaphorst-Johnson, 1).

- **Factors that are Uniquely Women Related:** The one immutable, enduring difference between men and women is maternity. Pregnancy remains the one issue where "female socialization" comes face to face with male corporate culture. Women who want the flexibility to balance their personal lives and their careers are viewed as inadequately committed to the organization (Nichols, 4). It is a serious dilemma for women who strive for high level careers to find balance between career and family. In many cases the family loses out (Smith, 4).

From a family perspective, it is often the woman who is expected to make career sacrifices rather than the man. Studies have shown that whereas the success of men's careers depends on including their wives, often women's professional success is achieved by withholding their family's identity (Holmes, 6). Along with the career gains these married professional women obtain, they frequently feel the anxiety that accompanies high expectations. They often find themselves desperately pressed for time. Unlike men, these women discover that it is difficult to compartmentalize the different parts of their lives, and that work and family constantly intrude on one anther (Gerstel/Gross 261).

Today, women still dominate in the home. Based on a study by the Family and Work Institute, women continue to be responsible for 87% of the shopping, 81% of the

cooking, 78% of the cleaning and 63% of the bill paying (Holmes, 5). Because of these family and domestic responsibilities, many women have been restricted in their choice of jobs and have found it necessary to engage in part-time work. In the high technology sector, this often has an adverse effect on future potential. Job displacement brought about by new information technology is more likely to adversely affect women in part-time positions because, due to family commitments, they often have limited access to training programs where they can learn new skills or they lack the flexibility to seek alternative employment (Simons, 4).

Yet there is some question about the desire of women in general for full time career work. Although 60% of all women today are in the workforce (Himelstein, 70), a study conducted by the National Science Foundation in 1996 found there is less interest among women in full time professional positions than among men. For example, male bachelor of science and engineering graduates are more likely to be in the labor force, to be employed full time, and to be employed in their field than are women. Women are more likely than men to be out of the labor force, to be employed part time, and to be employed outside their field (Women Scientists, 3). Even in the highest ranks of organizations, a Kron/Ferris study reported that only 14 percent of women surveyed aspired to be CEOs versus 46 percent of men (Pipes, 16).

A Louis Harris and Associates/Families and Work Institute/Whirlpool Foundation study of 1502 American women and conducted in 1995 found that of those surveyed, their work status was:

Self-employed	8 percent
Working full time	45 percent
Working part time	15 percent
Retired	1 percent
Unemployed	4 percent
Student	7 percent
Homemaker	17 percent

And when asked to choose among the following variables if they had enough money to live comfortably, those surveyed responded that they would prefer to:

Work Full Time	15 percent
Work Part Time	33 percent
Do volunteer work	20 percent
Work at home; care for family	31 percent

(Friedman, 55).

A 1996 Gallup Organization study based on interviews with more than 22,000 people, further illustrated women's preference for family. When asked "which is better for society: a family where both parents work for money and both take care of the house and children, or a family in which one parent works and the other takes care of the house and children," 62% of the women surveyed said the single working parent model (Kales, 16).

High Technology Has Two Faces

There are, in fact two segments of the high technology industry, classified as those espousing the Silicon Valley model and those subscribing to that of Route 128. Silicon Valley companies generally emerged within the counties of Santa Clara, San Mateo, Alameda, Santa Cruz, and to a lesser degree San Francisco, with the greatest concentration in the cities of Mountain View, Sunnyvale, Palo Alto, Santa Clara, San Jose, and Cupertino. Route 128 companies for the most part emerged within the counties of Midlesex, Essex, and Norfolk Massachusetts, with the greatest concentration in the cities of Lowell, Burlington, Lexington, Cambridge, Maynard, Waltham, Marlborough, and to a lesser degree Boston. Each of these two segments developed and grew under vastly different corporate structures, management styles, and workplace cultures. And each had a different impact on their employees and job opportunities within their sectors (Saxenian, 1-9).

The Silicon Valley model developed in an area that until the 1940s was farmland. From the outset, its pioneers saw themselves as outsiders to the industrial traditions that preceded them. Drawn together by the challenge of geographic and technological frontiers, they created a culture that "transcended firm and function, developing a regional network-based industrial system that promoted collective learning and flexible adjustment among specialist producers of complex of related technologies." These dense social networks and open labor markets encouraged experimentation and entrepreneurship (Saxenian, 29).

Silicon Valley companies competed intensely while at the same time they learned from one another about changing markets and technologies through informal communication and collaborative practices. This business culture encouraged intense involvement and enthusiasm among their workforce. Loosely linked team structures encouraged horizontal communication among those in the firm, its divisions, and with outside suppliers and customers (Saxenian, 2-3). There was a sense of community between the enterprises and local institutions such as trade associations, the financial community, and universities. By institutionalizing informal cooperation and exchange, the process of collective learning was formalized; the region as a whole was organized to create new markets and sectors continually. The system rewarded performance rather than seniority (Saxenian, 134).

From the outset Silicon Valley's pioneers saw themselves as outsiders to the industrial traditions of the East. The region's culture encouraged risk and accepted failure (Saxenian, 38). Even as the Silicon Valley firms grew larger, they were able to preserve many of the informal and entrepreneurial qualities of start-ups (Saxenian, 53). As they expanded their operations to other parts of the world, they replicated the pattern of geographic localization and workplace culture. They invested in local ties that allowed them to accumulate the local knowledge needed to respond more rapidly to the subtle differences between countries and regions in the ways a product is used and what customers expect of it (Saxenian, 158) .

Route 128 enterprises, in contrast, developed in an area with a long business tradition and adopted many of the practices of the past. Whereas Silicon Valley's entrepreneurs created an industrial system based on the region and its social and technical networks, their counterparts along Route 128 inherited and reproduced an industrial order based on a small number of independent firms that handled internally a wide range of activities. Practices of secrecy and corporate loyalty governed relations among firms and their customers, suppliers, and competitors, reinforced a regional culture that encouraged stability and self-reliance. Corporate hierarchies ensured that authority remained centralized and information could flow vertically. The boundaries between and within firms and between firms and local institutions remained more distinct in this independent firm-based system (Saxenian, 3-4)

Route 128's technology enterprises adopted the "autarkic" (corporate self sufficiency) practices and structures of the earlier generation Secrecy and territoriality ruled relations between individuals and firms, traditional hierarchies prevailed within firms, and relations with local institutions were distant -- even antagonistic. The regional economy remained a collection of autonomous enterprises, lacking social or commercial interdependencies. Even the venture capital industry was established by old-line East-Coast financiers and was managed by professional bankers rather than entrepreneurs (Saxenian, 60-64).

The managers of Route 128 technology companies were influenced by the bureaucratic structures of the established East coast corporation. They created organizations characterized by formal decision making procedures and management styles, loyal long term employees, and conservative workplace procedures, dress, and work styles. The CEO was ultimately responsible for all the important decisions. Status and pay were closely correlated with age; dress tended to be formal and provided a quick indication of an individual's position in the organization. In addition, senior managers were likely to be isolated from the rest of the organization in executive suites, private dining rooms, and reserved parking spaces. Most firms continued to rely on formal, vertical structure, more conservative top-down management styles, and significantly greater formality in communication systems and attitudes towards authority than those located in the Silicon Valley. In short the firms were stable, formal, and centralized organizations versus the loosely linked confederations of engineering teams in the Silicon Valley (Saxenian, 74-77).

Both the Silicon Valley and Route 128 boomed in the late 1970s and early 1980s. But by the end of the 1980s Route 128 had ceded its position as the focus of computer innovations to the West Coast (Saxenian, 103). Although the autarkic structures of Route 128's independent firm-based systems had provided economic scale and organizational stability valuable in an environment of volume markets and price based competition, by the 1980s it was inadequate for the accelerating pace of technological and market change.

Its emphasis on corporate secrecy, vertical integration, and formal hierarchies stifled opportunities for experimentation and learning; its traditional corporate structures and paucity of horizontal communications limited the development of managerial initiative and skill. The area's commitment to vertical integration meant that technical capabilities and know-how in the region remained locked up within large firms, while the legacy of corporate secrecy further inhibited enterpreneurship in the region. New ventures rarely knew about other local start-ups and there were few forums at which to develop role models or to learn from the experiences of other local entrepreneurs. In the end the Silicon Valley overwhelmed Route 128 by continuing to introduce a stream of high-value added semiconductors, computers, components, and software-related products, while Route 128 remained shackled by institutional and cultural rigidities and fell further behind technologically (Saxenian, 105-116).

An interesting example of the differences between Silicon Valley and Route 128 enterprises can be seen by contrasting the two companies that are considered the pioneers of the industry for their regions. Hewlett Packard (HP), founded in the Silicon Valley, developed a management style termed "the HP Way." It was based on a heritage of participatory management that supported, even demanded, individual freedom and initiative while emphasizing commonness of purpose and teamwork. HP also pioneered a decentralized organizational structure that represented an important departure from traditional corporate organizations. It eliminated most traditional corporate symbols of

hierarchy and status, including private offices, reserved parking spaces, and differentiated attire and office furniture, and created a work environment that was less formal and centralized and more open and egalitarian than traditional East Coast corporations (Saxenian, 50-51). First and foremost, it was an entrepreneurial firm in which individuals enjoyed substantial freedom and unit managers maintained a unique independence (Prahald, 125).

Like the Silicon Valley founding fathers, Digital Equipment Corporation (DEC) consciously downplayed status and hierarchical authority and eschewed status symbols. It did not have a traditional Eastern structure, but operated as an "engineer's sandbox" under the belief that good ideas could come from anywhere in the organization. (Peters, 218). This represented an ambiguous intermediate model -- falling between the traditional corporate structure and the more flexible Silicon Valley model. This hybrid organizational structure, however, had some distinct weaknesses, the major one being it often created confusion and conflict and served to isolate DEC from the region (Saxenian, 74-76). It had a tendency to undermine informal communications and decision making processes and distance management from employees and customers. Marketing remained secretive and account development excessive; the focus was on maintaining control (Moore, 154).

By 1990, both DEC and HP were $13 billion companies and the largest and oldest civilian employers in their respective regions. Both produced similar products. Both faced equal competitive challenges. But each responded to the new decade differently. HP opened itself up further, adding to its network of local alliances and subcontracting relationships while maintaining global operations; DEC, in spite of a formal commitment to decentralization, remained substantially more insular. The result was that by 1992, HP surpassed DEC in sales to become the nation's second largest computer company after IBM (Saxenian, 134-140).

The fall of Route 128 is to a great extent the product of its history. The region's high technology firms inherited a business model and a social and institutional setting from an earlier industrial era. When technology remained relatively stable, vertical integration and corporate centralization offered needed economies of scale and market control. In an age of volatile technologies and markets, however, the horizontal coordination provided by interim networks enabled those firms to retain the focus and flexibility needed for continuous innovations. Although Silicon Valley's success has been credited to its collaborative practices, the region has long been dominated by the language of individual achievement (Saxenian, 162-164).

PREDICTIONS FOR THE FUTURE OF WOMEN IN HIGH TECHNOLOGY COMPANIES

The accelerated and seemingly unstoppable growth of high technology during the past few years, coupled with the overwhelming dominance of the Silicon Valley business model, indicate a very positive omen for woman. The increased emphasis on needs analysis, teamwork, methodical project management, and cross functional skills has made this sector a much friendly environment for aspiring women (Goff, 61). Of the 2005 occupations categorized by the U.S. Bureau of Labor Statistics, high technology "cutting edge" fields topped Working Woman Magazine current list of the 25 hottest careers for women (Jones, 37).

There also is a trend towards female advancement. Social science has classified occupational composition as a dual-queuing process: labor queues, which order groups of workers in terms of their attrractiveness to employers, and job queues, which rank jobs in terms of their attractiveness to workers (Reskin, 29). The high technology industry has served to alter both. In fact there may just be a reverse gender gap in fields such as computer science. Jobs are plentiful and as Information Systems mangers scramble to fill the ranks, many are seeking out women for positions in what was once nearly an all-male field. The old paradigm of women competing with men has even been reversed in some instances, as women now find themselves competing with other women in those

companies that "have a mandate to diversify" (Didio, 1). As organizations continue to trim due to the intensely competitive nature of business, fewer levels now separate women from the top. What has occurred is that many enterprises, having found that putting women in senior posts helps to bring more talent in the door, are accelerating the hiring of women in general, recognizing that over time the best candidates will become harder to attract and retain (Himelstein, 64).

Statistics indicate just how widespread this trend has become. Over the last decade, the number of female Executive Vice Presidents have more than doubled and the number of female Senior Vice Presidents have increased by 75%. The number of women interested in climbing the corporate ladder has grown significantly. While only four out of ten men in a recent Chief Executive Magazine survey expected to be part of their company's senior management team in the year 2000, six out of ten women in the survey expected to be exercising such power (Pipes, 16). Board level representation has increased as well. By the beginning of 1997, 97% of the top Fortune 100 companies had at least one woman director and 59% had multiple female directors (Women Break, 12).

The ratio of male to female knowledge workers -- engineers, scientists, technicians, professions, and senior managers -- which was three to two in 1983, has changed as well; today it is virtually one to one. Of the twenty top paid women in corporate America, four of the top ten and eight of the top twenty are in fields that are driving the new economy: computers and semiconductors, health care and medicine, communications and

telecommunications, and instrumentation. In these fields, a person's value is in his or her knowledge and their speed in adjusting to rapid change, not title or years of loyal service. This plays to women's advantage because they are, on average, better educated than men in the work force; the more they find work in fields that reward skills and learning rather than seniority, the better their opportunities ($1 million, 24-25).

Technology itself has helped propagate this transformation. Electronic mail, which is now used by most large enterprises, has a way of flattening the organization. The Internet, another growing area, serves as a democratizing agent. Both are making it easier to balance career and family by enabling work at home via a computer (Fryer, 58-9). In fact, many high technology companies are actually promoting telecommuniting and flex-time, which for women is an offsetting benefit in enabling them to better balance family and work (De Bare, 5). Others are offering separate career tracks, termed "career primary" and "career and family," so they can channel employees appropriately (Nichols, 4).

Attitudes are changing as well. A massive study of more than 900 managers at large American enterprises conducted since 1988 found that women's effectiveness as managers, leaders, and teammates outstrips the ability of their male counterparts in 28 of 31 managerial skill areas -- including the challenging areas of meeting deadlines, keeping productivity high, and generating new ideas. Results of a study released by the Foundation for Future Leadership, a not-for-profit Washington based organization dedicated to studying and evaluating leadership characteristics, is a departure from

traditional presumptions that credit women for being nurturing team players but lacking in the skills necessary for top level management roles. Traditionally, women have been given credit for their intuitive skills and while this study confirmed that they do outperform men in this area, it also showed that women perform even more strongly in logic-based skills than was indicated in previous studies (Moskal, 18).

In terms of delegating authority, men and women in the Foundation's study received the same mean score. Men rated higher in two behavioral areas -- handling pressure and coping with their own frustrations. But in the remaining 28 categories of skills/behaviors necessary for managerial and executive effectiveness, women were rated as doing better than their male counterparts and statistically outperforming them in the task orientation, analysis and control areas of organizing work, keeping performance within defined levels, and making sure that events happen when and as they are supposed to. Women were found to stay on top of their work more closely, be more likely to keep commitments, and deliver projects on time (Moskel, 17-18).

In terms of leadership, the study found that women practiced leadership with a subtle difference from men. In reviewing the leadership performance factors -- delegating authority, facilitating meetings, motivating, inspiring, developing, and giving recognition to others -- women were more likely than men to dispense advice and guidance regarding the requirements for the successful completion of tasks and clarify the expected outcomes with those doing the work (Moskel, 17-18).

In the area of communicating, the study found women more effective than their male colleagues, receiving higher ratings in all five communicating behaviors -- articulating ideas; listening to others; keeping others informed; giving performance feedback, and communicating expectations. Also, women were more apt to let others know what they needed and expected in the way of support. They sought clarity of communication, which ultimately reduced confusion and conflict (Moskal, 18-19).

As the new economy, powered by knowledge-based industries, continues to supplant its old manufacturing predecessors, what is happening is a true change in culture. In this new economy, women are well positioned to thrive ($1 million, 24-25); in fact historically women have always done well "at the beginning of new markets when they are wide open" (Fryer, 60). The growth of women in the high technology sector has been so accelerated that it has even evoked something of a eulogy. The Economist, in a recent feature story, rendered men all but obsolete in the Information Age, as their comparative advantage of aggressiveness and upper body strength diminishes in value (Pipes, 16).

Former president of Apple Computer, John Sculley, most succinctly described today's high technology business environment. Instead of a culture that limits the enterprises by "an emphasis on tradition, on yesterday's heroes, on myths and on rituals," new age companies, he states "have adopted a culture genetic change. As cells grow and divide, genetic code is always present, yet the code's message is always expressed differently in

different organisms. Genetic coding imprints notions of identity and values as culture does, but in so doing suggests a sense of forward-looking, a sense that everything done today is an investment in the future, not an expression of the past. The code is constant over a lifetime, but cells can change metaphorically. This becomes a forward looking model" (Scully, 13). And it is this forward looking model that appears to be the driving force that could finally spell equal opportunity for women in the business world.

RESULTS OF CASE STUDY: Century Analysis, Inc.

As a way to further explore the hypothesis that high technology companies provide more growth opportunities for women, a survey was conducted of the employees at Century Analysis Inc., a Northern California-based high technology software manufacturer. Although not founded in the Silicon Valley per se, its proximity to it (approximately 60 miles) gave it much of that areas culture.

The company was established in 1975 in a small, focused niche of the computer software marketplace, and grew successfully during its first decade of its existence to dominate its sector. However, in the early 1980s, the company recognized that this niche was beginning to decline, and was forced to completely reinvent itself in order to stay in business. It took most of that decade to make the transition; for all intents and purposes, the company was virtually reborn in the late 1980s with new technology and products targeted at a larger, more prominent market sector.

Through the transition, a large number of early employees were retained and promoted into new departments and positions; many, however, either by their own choosing or as a result of performance, were not able to make the transition and left the company's employ. After the introduction of the new products, sales and revenues began to increase, and many new employees were introduced into the company, some in significant positions that were newly created as a result of growth.

This study was conducted in April 1997. Questionnaires were submitted to all 97 male and 46 female U.S. based company employees in an effort to determine whether they saw a parallel between occupational advancement/job enrichment and this company's high technology business model. The survey contained two parts with a total of seven questions regarding work environment and six questions regarding demographics. Questions were closed ended. The work environment questions followed a five point scale, ranging from 1. Strongly Agree; 2. Agree; 3. Disagree; 4. Strongly Disagree; and 5. No Opinion. The demographics were multiple choice and addressed gender; length of employment and position(s) held.

33% of the employees returned the survey: 55% male, 45% female. This represented 27% of all male employees and 46% of all female employees. Of those that responded, 73% were in staff positions, 24% were in management; and 3% were in senior management. These percentages are very representative of the employee base as a whole. 38% of the respondents had less than one year of service; 48% had one to five, and 16% had more than five; this, too, was representative of the employee base, as recent growth had introduced a large number of new employees into the company. The average length of time the respondents had in their current position was 1.96 years; the number of positions they had held at the company during their careers averaged 1.91.

The results were tabulated by gender. The following represents the respondent's opinions regarding the following categorical questions about Century Analysis, Inc.:

	Males	Females
a. Provides a creative work environment		
Strongly Agree	38%	23%
Agree	50	61
Disagree	7	5
Strongly Disagree	5	0
No Opinion	0	11
Total:	100%	100%
b. Provides career opportunities		
Strongly Agree	40%	57%
Agree	50	43
Disagree	5	0
Strongly Disagree	5	0
No Opinion	0	0
Total:	100%	100%
c. Provides better career opportunities thannon high-technology companies		
Strongly Agree	20%	23%
Agree	29	39
Disagree	23	19
Strongly Disagree	5	0
No Opinion	23	19
Total:	100%	100%
d. Provides career opportunities for women		
Strongly Agree	29%	34%
Agree	40	61
Disagree	0	5
Strongly Disagree	0	0
No Opinion	31	0
Total:	100%	100%
e. Provides career opportunities for minorities		
Strongly Agree	31%	14%
Agree	50	86
Disagree	0	0
Strongly Disagree	0	0
No Opinion	19	0
Total:	100%	100%

f. Provides job security

Strongly Agree	7%	14%
Agree	27	49
Disagree	36	19
Strongly Disagree	15	4
No Opinion	15	14
Total:	100%	100%

g. Provides recognition for performance

Strongly Agree	20%	23%
Agree	59	43
Disagree	5	19
Strongly Disagree	5	4
No Opinion	11	11
Total:	100%	100%

These results show that both the male and female respondents saw the company as a creative work environment, one that did provide career opportunities. Neither felt that these opportunities were, however, more pronounced than companies in other business sectors. There was also agreement between the male and female respondents that the company, like the industry sector it is in, did not provide especially strong job security, and that the recognition they received for their performance was, on average, adequate. Where the numbers strongly differed, however, was in the area of career opportunities for women and minorities. Whereas 69% of the male respondents either strongly agreed or agreed that Century Analysis provided good career opportunities for women, 81% of the women responded in the affirmatives. To the question regarding career opportunities for minorities, 81% of the male respondents either strongly agreed or agreed, while 100% of the women responded in the affirmative.

Although this study does not purport to be highly scientific and does only represent the views of 33% of one company's employee base, the responses do corroborate, at least in the opinion of the women respondents, that Century Analysis, a high technology employer, did provide good career opportunities for women. In fact, the company has always espoused a philosophy of equal employment, and currently has 33% women in first level management positions, 50% women in mid-level management positions, and 38% women in senior management positions. The President of the company is also a woman.

CONCLUSION

The profound changes that have affected business within in last decade have had a transformational effect on corporate structure. The emphasis on teamwork, better quality, improved service, faster time to market, product and customer focused units, and minimal layers of management has shifted the focus of business away from machinery and equipment to intellectual capital (ideas and talent). And the tremendous growth of the high technology sector, which today represents 27% of the growth in the gross domestic product (GDP) and 20-25% of the growth in real wages and incomes, has created a virtually limitless number of jobs with no end in sight.

For women in business, this is promising. There is evidence of real progress in women's representation within many high technology job classifictions. And the prospect for the future continues to look bright. Working Women's Magazine classified "cutting edge" fields at the top of its most current list of the 25 hottest careers for women (Jones, 37). And at the most recent "Women in Technology" Conference, conducted by WITI, an organization with 6,000 members, 95% of whom are professional women working in technology organizations, there was general agreement that technology represented one of the best ways to get into male dominated fields (DiDio, 14).

The proliferation of jobs, with a scarcity of applicants to fill them, the growing awareness of gender equality, and the proliferation of computers and computer technology, which is being introduced to students of both genders at a younger and younger age, are all indicators of a true and permanent transformation of the business world. All of this should finally serve to break down the stereotypical barriers of the past and provide a truly even playing field for women.

Although the research conducted within this paper does not produce absolutes, it does appear that there is sufficient evidence to support the premise that there is enhanced employment opportunities for women in today's high technology business secctor. Although definitive answers will come over time, it seems probable that the new economy, powered by high-technology, knowledge-based industries, will continue to grow, heightening the prospect for women with career interests in the corporate world.

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