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I. INTRODUCTION


WHAT HAS CHANGED IS THIS: A DILEMMA, IMPERCEPTABLE TO MANY TEN YEARS AGO, HAS GROWN TO A SIZE THAT EVEN THE MOST BLIND CAN SEE IT. THAT DILEMMA IS THIS: ON THE ONE HAND, PROBLEMS SUCH AS INADEQUATE EDUCATION AND HEALTH CARE SYSTEMS, DECAYING INNER
CITIES, INFLATION, ESCALATING ENERGY COSTS, DECLINING RATES OF PRODUCTIVITY GROWTH, POVERTY STRICKEN RURAL AREAS AND LACK OF AFFORDABLE HOUSING HAVE GROWN STEADILY LARGER. THESE PROBLEMS CRY FOR SOLUTION -- AND THE SOLUTIONS SHOULD BE A VAST SOURCE OF NEW JOBS FOR MANY PEOPLE.

IRONICALLY, HOWEVER, THE OPPOSITE HAS OCCURRED. WHAT WE HAVE SEEN IS RISING UNEMPLOYMENT. ACCORDING TO THE OECD, BY MID-1982 THERE WILL BE 26 MILLION PEOPLE UNEMPLOYED IN THE OECD COUNTRIES. 26 MILLION PEOPLE WHO SIMPLY DON'T WORK. 26 MILLION PEOPLE WHO BECAUSE THEY ARE UNEMPLOYED ARE A MAJOR SOURCE OF INFLATION.

THE SOLUTION TO THIS SEEMINGLY SELF-CONTRADICTORY DILEMMA OF A GROWING NEED FOR WORK TO BE DONE CO-EXISTING WITH GROWING UNEMPLOYMENT IS TECHNOLOGICAL INNOVATION. UNFORTUNATELY, WE ARE NO BETTER POSITIONED TO FOSTER NEEDED INNOVATION TODAY THAN WE WERE TEN YEARS AGO. WE MUST CHANGE THAT. WE MUST CHANGE IT NOW, IN THIS DECADE -- AND THAT, AS SIMPLY AS I CAN PUT IT, IS THE CHALLENGE.

II. BARRIERS

NOW, IF NEEDED INNOVATION IS NOT TAKING PLACE IT'S BECAUSE THERE ARE BARRIERS -- PERCEIVED AND UNPERCEIVED. AS YOU MIGHT GUESS, ALTHOUGH THEY ARE REAL ENOUGH, THE PERCEIVED BARRIERS
ARE ACTUALLY THE LESS IMPORTANT AS A FOCUS OF CORPORATE ATTENTION. THERE IS MUCH DISCUSSION ABOUT THE BURDENS OF GOVERNMENT REGULATION, OF FISCAL POLICIES WHICH ACT AS DETERRENTS TO NEEDED INVESTMENT AND OF THE NEED FOR MONETARY POLICY CONDUCIVE TO A HEALTHY BUSINESS ENVIRONMENT. THE PROBLEM IS NOT THAT THESE BARRIERS ARE IMAGINARY, THEY ARE VERY REAL. THE PROBLEM IS THAT THEY PREVENT US FROM SEEING--AND ADDRESSING -- THE MUCH LARGER AND MORE DIFFICULT BARRIERS WHICH MUST BE OVERCOME IF TECHNOLOGICAL INNOVATION IS TO OCCUR ON THE SCALE NEEDED. TO PUT IT MORE BLUNTLY THEY HAVE BECOME AN EXCUSE. BUT, WITH THE RAPID REMOVAL OF GOVERNMENT REGULATION AND REVISION OF TAX LAWS, IT WILL SOON BECOME EVIDENT ENOUGH THAT THERE ARE MORE FUNDAMENTAL BARRIERS. THREE OF THEM ARE MATTERS OF LIMITATIONS, THREE OF THEM MATTERS OF ATTITUDE. ALL OF THEM MUST BE ADDRESSED. TOGETHER THEY REPRESENT A CHALLENGE TO INNOVATION OF UNPRECEDENTED PROPORTIONS.

INADEQUATE ACCESS TO TECHNOLOGY. WE CAN START WITH ACCESS TO TECHNOLOGY. I REFER TO TECHNOLOGICAL ACCESS ADVISEDLY. WHILE THERE IS CERTAINLY A NEED FOR INVESTMENT IN RESEARCH TO DEVELOP NEW TECHNOLOGY, WHAT IS NEEDED EVEN MORE IS BETTER USE OF WHAT IS AVAILABLE. IMPORTANT TECHNOLOGY LIES DORMANT IN UNIVERSITIES, GOVERNMENT LABORATORIES AND BUSINESS... NONE OF IT EVER APPLIED TO IMPORTANT PROBLEMS. MAJOR RESEARCH AND DEVELOPMENT PROJECTS ALMOST ININVARIABLY DEVELOP "PERIPHERAL"
TECHNOLOGIES -- BUT NO DOLLARS OR STAFF TIME ARE ALLOCATED FOR ITS DESCRIPTION, CATALOGING AND DISSEMINATION. UNIVERSITIES STRUGGLE DESPERATELY FOR REVENUES TO OFFSET RISING COSTS, BUT FEW OF THEM HAVE MECHANISMS TO CAPITALIZE ON TECHNOLOGY DEVELOPED AS PART OF RESEARCH PROJECTS. IN BUSINESS -- ESPECIALLY IN LARGE CORPORATIONS -- WE ARE CONTINUALLY PLAGUED BY THE "NOT-INVENTED-HERE" SYNDROME WHICH PRECLUDES LOOKING AT WHAT MIGHT BE AVAILABLE ELSEWHERE. AS A CONSEQUENCE, MOST LARGE CORPORATIONS HAVE NO EFFECTIVE METHOD FOR SEARCHING OUT AND EVALUATING TECHNOLOGY. IN SHORT, THE ABSENCE OF ADEQUATE TRANSFER MECHANISMS MEANS THE TECHNOLOGICAL WHEEL IS BEING RE-INVENTED EVERY DAY ALL OVER THE WORLD. WE MUST FIND MORE EFFICIENT WAYS TO GIVE ACCESS TO TECHNOLOGY THAT ALREADY EXISTS. IF WE DON'T, WE WILL CONTINUE TO STUMBLE ALONG, BUMPING INTO EACH OTHER IN THE DARK.

RESOURCE REQUIREMENTS. ANOTHER BARRIER TO INNOVATION IN TODAY'S WORLD IS THE SHEER SIZE OF THE RESOURCES REQUIRED -- SOMETHING QUITE DIFFERENT FROM THE WAY THINGS USED TO BE.

THE SEMI-CONDUCTOR INDUSTRY HAS BEEN CHARACTERIZED BY ITS WILLINGNESS TO INVEST IN R&D -- THE INDUSTRY AVERAGE OF 7.3 PERCENT OF REVENUES SPENT FOR R&D IS CONSIDERABLY HIGHER THAN THE ALL-INDUSTRY AVERAGE OF 2.3 PERCENT. THE SPECTRUM OF
TECHNOLOGY THAT MUST BE COVERED -- AND THE INCREASING CAPITAL COST OF DOING SO -- IS SUCH THAT EVEN THE LARGEST COMPANIES ARE NOT ABLE TO COVER ALL THE BASES.

MANY OF US THINK OF IBM AS A COMPANY OF UNLIMITED RESOURCES. YET THE SCOPE AND MAGNITUDE OF THE NEED FOR RESEARCH AND DEVELOPMENT IS SO GREAT, THAT IN 1980 IBM REVERSED A POLICY OF MAKING EACH OF ITS MAJOR GROUPS SELF-SUFFICIENT IN MICRO-ELECTRONICS AND CENTRALIZED THIS ACTIVITY. MORE SIGNIFICANTLY WE BEHOLD THE ALMOST UNIMAGINABLE PHENOMENON OF IBM FOSTERING INDUSTRY COOPERATION. YES, IBM HAS BEEN THE DRIVING FORCE IN THE RECENT ESTABLISHMENT BY THE SEMICONDUCTOR INDUSTRY ASSOCIATION OF A RESEARCH COOPERATIVE TO POOL UNIVERSITY RESEARCH DOLLARS.

BUT THE SIZE OF THE FINANCIAL RESOURCES NEEDED FOR R&D IN INDUSTRY PALE WHEN COMPARED TO THE AGGREGATION OF FINANCIAL, TECHNICAL AND HUMAN RESOURCES NEEDED TO ADDRESS OUR MAJOR SOCIAL NEEDS -- AND THE ISSUE HAS BECOME VERY REAL AS THE PRIVATE SECTOR IS BEING CALLED UPON TO MAKE UP FOR THE DECREASED FEDERAL GOVERNMENT ROLE IN SOCIAL SERVICES. THE PREVAILING VIEW OF THE PROPER PRIVATE SECTOR RESPONSE IS FOR CORPORATIONS TO INCREASE THEIR CHARITABLE CONTRIBUTIONS.
BUT THE GAP TO BE BRIDGED IS JUST TOO GREAT -- IT WOULD REQUIRE PRIVATE GIVING TO BE INCREASED BY 150 PERCENT BY 1984 TO $90 BILLION. THAT JUST Isn'T GOING TO HAPPEN. BUSINESS IS UNDER ENORMOUS PRESSURE TO ALLOCATE MORE FUNDS TO INCREASE PRODUCTIVITY, TO FEND OFF GROWING FOREIGN COMPETITION, TO OFFSET THE RAVAGES OF INFLATION, WHILE DOING ALL THAT TO IMPROVE EARNINGS. ON TOP OF THAT, THERE IS NO TAX INCENTIVE FOR CHARITABLE GIVING.

THE ONLY ANSWER TO THE GAP IN SOCIAL FUNDING IS AN APPROACH WHICH FOCUSES ON NEW TECHNOLOGY AND THE DIRECT INVOLVEMENT OF THE PRIVATE SECTOR -- NOT ON A PHILANTHROPIC BASIS, BUT AS PART OF A CORPORATION'S MAINSTREAM, PROFIT-DRIVEN BUSINESS. UNFORTUNATELY, THE RESOURCES REQUIRED TO ADDRESS MANY OF OUR MAJOR SOCIAL NEEDS ARE CLEARLY BEYOND THOSE AVAILABLE IN ANY ONE COMPANY -- AND THAT LEADS TO ONE OF THE ATTITUDINAL BARRIERS I'LL BE DISCUSSING IN A FEW MOMENTS: THE AVERSION TO COOPERATION.

INADEQUATE TRAINING AND EDUCATION. A THIRD BARRIER TO INNOVATION IS A LACK OF TRAINED PEOPLE. EVERY YEAR JAPAN GRADUATES TWICE AS MANY ELECTRICAL AND ELECTRONIC ENGINEERS AS DOES THE U.S. THE SOVIET UNION PRODUCES THREE TIMES AS MANY. MOREOVER THE DISCREPANCY IS INCREASING NOT DECREASING. TO MEET THE NEED FOR GREATER INNOVATION, WE NEED MORE ENGINEERS. TO
MEET THE NEED FOR MORE ENGINEERS, WE NEED MORE QUALIFIED HIGH
SCHOOL GRADUATES -- PARTICULARLY MINORITY GRADUATES. BUT
RATHER THAN PRODUCING MORE AND BETTER, OUR PUBLIC SCHOOL SYSTEM
PRODUCES LESS AND WORSE. A RECENT STUDY INDICATED THAT THE
COST OF BRINGING ALL AMERICANS AGED 20-29 UP TO THE LEVEL OF
HIGH SCHOOL EQUIVALENCY BY TRADITIONAL METHODS WOULD BE $96
BILLION. SO THERE IS NOT EVEN ENOUGH MONEY TO CATCH-UP MUCH
LESS TO IMPROVE -- UNLESS WE TAKE A NEW AND INNOVATIVE APPROACH
TO TRAINING AND EDUCATION.

NOW LET ME MOVE ON TO THREE BARRIERS OF A DIFFERENT NATURE —
BARRIERS OF ATTITUDE.

RESISTANCE TO CHANGE. WE ALL TALK OF CHANGE. WE READ BOOKS
WITH TITLES LIKE THE THIRD WAVE. WE HONESTLY BELIEVE THAT WE
FOSTER CHANGE IN OUR BUSINESSES. IN PRACTICE, CHANGE IS ALL
TOO RARE. DISCUSSING THIS IN AN INTERVIEW RECENTLY, DAVE
KEARNS OF XEROX SAID: "NO ONE IS COMFORTABLE WITH...REAL
CHANGE...YOU KNOW THE VERNIER KNOB ON YOUR STEREO? THE ONE
THAT GIVES YOU VERY FINE TUNING? WELL, MOST PEOPLE IN BUSINESS
(JUST) TURN THE VERNIER KNOB. THEY'RE GETTING FINE TUNING, NOT
REAL CHANGE."

WHEN YOU STOP TO THINK ABOUT IT THIS IS NOT VERY SURPRISING.
CHANGE INVOLVES RISK. THE LARGER THE ORGANIZATION, THE MORE
THERE IS AT RISK -- AND THE MORE DEEPLY INGRAINED THE
RESISTANCE TO CHANGE. A LONG TIME AGO, I READ SOMETHING
CHARLES EVANS HUGHES WROTE: "EVERYDAY PUTS AT RISK ALL THAT
HAS BEEN GAINED -- THE GREATER THE ACHIEVEMENT, THE MORE
SERIOUS IS THE RISK OF LOSS." I DIDN'T REALLY APPRECIATE THOSE
WORDS UNTIL RECENT YEARS WHEN THE RESPONSIBILITY FOR INDUCING
CHANGE IN A LARGE ORGANIZATION BECAME A PERSONAL
RESPONSIBILITY. IF THIS IS DIFFICULT IN A FAST MOVING, CHANGE
SEEKING COMPANY LIKE CONTROL DATA, THEN YOU CAN GUESS THE
BARRIER MUST BE TRULY FORMIDABLE IN SOME OTHER ORGANIZATIONS.

SHORT-TERM VIEW. ANOTHER ATTITUDINAL BARRIER PARTICULARLY
PLAGUING THE U.S. ECONOMY IS THE SHORT-TERM VIEW PREVALANT IN
BOTH GOVERNMENT AND INDUSTRY. BUSINESS WEEK, IN ITS 50TH
ANNIVERSARY ISSUE, PUT IT THIS WAY: "THE AMERICAN SYSTEM IS
LARGELY GEARED TO THE HERE AND NOW. MANAGERS OF LARGE PUBLIC
CORPORATIONS TEND TO BE PREOCCUPIED WITH QUARTERLY AND ANNUAL
FINANCIAL RESULTS. GOVERNMENT FOCUSES ON THE TWO TO SIX-YEAR
PERIOD BETWEEN ELECTIONS." TO DESCRIBE THE TOTAL EFFECT OF
THIS SHORT-TERM VIEW WOULD BE A SPEECH IN ITSELF, BUT IT'S
REFLECTED PRIMARILY IN AN UNWILLINGNESS TO ACCEPT LOWER
SHORT-TERM RETURNS IN FAVOR OF MORE SUBSTANTIAL, STABLE AND
ENDURING LONG-TERM OPPORTUNITIES. A MAJOR PART OF THE
DIFFICULTY IS THE SLAVISH COUPLING OF MANAGEMENT COMPENSATION
TO ANNUAL BUDGETS AND PERFORMANCE. THE NET EFFECT, THEN, IS A
PREOCCUPATION WITH COST REDUCTION AND COSMETIC CHANGES TO EXISTING PRODUCTS AND SERVICES RATHER THAN INNOVATION TO MEET NEW NEEDS.

COOPERATION. FINALLY, THERE IS THE BARRIER WHICH WAS REFERENCED A MOMENT AGO: THE BELIEF THAT COOPERATION IS ANTITHETICAL TO COMPETITION. THIS BELIEF IS DEEPLY INGRAINED IN OUR CULTURE AND IS PRIMARILY DUE TO THE FACT THAT PEOPLE DON'T DISTINGUISH BETWEEN MARKETING COOPERATION AND TECHNOLOGICAL COOPERATION. THERE IS A MISPLACED CONCERN FOR MAINTAINING PROPRIETARY POSITIONS. IN THE PAST, INDIVIDUAL COMPANIES HAVE BEEN ABLE TO DEVELOP NEW PRODUCTS AND TO PROVIDE AN ATTRACTIVE RETURN ON INVESTMENT WITHOUT TAKING UNREASONABLE RISKS OR FACING UNAFFORDABLE TECHNICAL COSTS. BUT CIRCUMSTANCES ARE CHANGING. IT'S GETTING TOUGHER TO BRING IN NEW PROPRIETARY PRODUCTS -- MORE COSTLY, MORE TIME-CONSUMING AND MUCH RISKIER. THIS REINFORCES THE TREND TOWARD COSMETIC INNOVATION AND COST REDUCTION. AS A RESULT, COMPANIES IN MOST INDUSTRIES ARE SELLING THE SAME BASIC PRODUCT. THE DIFFERENCES ARE IN MARKETING: IN APPLICATIONS AND CUSTOMER SERVICES. SO CONCERN FOR PROPRIETARY POSITION IS ROOTED MORE IN TRADITION THAN LOGIC. WHILE THERE ARE REASONS TO PROTECT PROPRIETARY ELEMENTS IN THE MARKETING PROCESS, THE TIME HAS PASSED FOR SUCH PROTECTION TO BE A MAJOR CONSIDERATION IN RESEARCH AND DEVELOPMENT.
OUR OWN COMPUTER INDUSTRY IS A CASE IN POINT. AN ENORMOUS
duplication of research and development has been going on for
the past twenty-five years -- yet no exclusionary proprietary
positions have resulted. Moreover, continued fragmentation and
duplication of R&D has made it much easier for the Japanese to
catch up technically. If the present lack of cooperation
continues in the U.S., what happened in Detroit can very well
happen in the computer industry. Control Data has participated
in cooperative efforts to a much greater extent than any other
company, and we have benefitted handsomely. At no time has it
been disadvantageous.

And if cooperation is ever to take place on a truly meaningful
scale, we must also end the adversarial relationship which
exists between government and industry. Business people want
government to leave them alone. Government officials are
suspicious of business and mistrust its motives. This isn't
exactly a healthy climate. But businesses and public
institutions must cooperate in finding technological
innovations to address our major social needs.

III. TECHNOLOGICAL INNOVATION AT WORK

Let me summarize: inadequate access to technology, massive
resource requirements, inadequately skilled workers, resistance
to change, misguided adherence to short-term view and a poor
CLIMATE FOR COOPERATION. THE ROAD TO TECHNOLOGICAL INNOVATION IS INDEED FILLED WITH BARRIERS. STILL, THESE BARRIERS CAN BE OVERCOME. TECHNOLOGICAL INNOVATION CAN FLOURISH, AND BRING WITH IT THE BENEFITS OF JOB CREATION AND INCREASED PRODUCTIVITY.

LET ME GIVE YOU THREE EXAMPLES.

SMALL BUSINESS.

IT IS WELL KNOWN THAT INNOVATION OCCURS MORE FREQUENTLY AND MORE RAPIDLY IN SMALL COMPANIES THAN IN LARGE COMPANIES. PARTLY THIS IS BECAUSE SOME OF THE BARRIERS TO TECHNOLOGICAL INNOVATION SIMPLY DO NOT EXIST. SHEER SURVIVAL REQUIRES A WILLINGNESS TO TAKE RISKS AND LOWERS RESISTANCE TO CHANGE. THE UNAVAILABILITY OF RESOURCES PRODUCES A CLIMATE OF OPENNESS, A WILLINGNESS TO LEARN AND COOPERATE WITH WHOMEVER NECESSARY.

SMALL COMPANIES ARE ALSO A MAJOR SOURCE OF JOB CREATION. FROM 1969 TO 1976, WHILE EMPLOYMENT GREW BY NINE MILLION IN THE UNITED STATES, THE FORTUNE 1000 COMPANIES CREATED NO NET INCREASE IN JOBS. ZERO.

YET THE CLIMATE FOR SMALL BUSINESS HAS BECOME INCREASINGLY WORSE DURING THE PAST DECADE. HERE, IN MINNESOTA, WE HAVE AN EXAMPLE OF WHAT CAN BE DONE TO REVERSE THAT TREND. WE HAVE A
NETWORK FOR INNOVATION THAT PROVIDES THE SUPPORT NEEDED FOR EACH MAJOR LINK IN THE CHAIN OF SUCCESS FOR SMALL ENTERPRISE: ACCESS TO TECHNOLOGY, FINANCE, MANAGEMENT ASSISTANCE, EDUCATION AND TRAINING, MARKETING, AND EFFICIENT ACCESS TO SERVICES.

FORGING THE LINKS IN THE CHAIN HAS BEEN A COOPERATIVE UNDERTAKING OF INDUSTRY, GOVERNMENT AND ACADEMIA. THIS MORNING I HAVE TIME TO DESCRIBE ONLY A FEW OF THE ORGANIZATIONS SET UP TO CREATE THIS CHAIN.

LET ME START WITH THE MINNESOTA COOPERATION OFFICE. CREATED UNDER THE AUSPICES OF THE MINNESOTA BUSINESS PARTNERSHIP, THE MCO IS A NON-PROFIT CORPORATION BEING FINANCED DURING ITS EARLY YEARS BY CONTRIBUTIONS AND GRANTS; EVENTUALLY IT WILL BECOME SELF-SUPPORTING THROUGH CLIENT FEES AND FUNDS GENERATED BY INVESTMENTS IN CLIENT COMPANIES.

THE MCO'S BOARD OF DIRECTORS CONSISTS OF LEADERS FROM ALL MAJOR SECTORS OF SOCIETY. THE APPROACH IS SIMPLE: AN ENTREPRENEUR HAS AN IDEA FOR A NEW PRODUCT OR SERVICE AND WANTS TO START A COMPANY -- THE MCO HELPS DEVELOP A BUSINESS PLAN AND OBTAIN FINANCING. THE PERMANENT STAFF IS SMALL, BUT THE MCO DRAWS ON A VOLUNTEER ADVISORY PANEL OF ENGINEERS, SCIENTISTS AND EXECUTIVES FOR THE SPECIFIC EXPERTISE REQUIRED TO EVALUATE AND
HELP PREPARE THE BUSINESS PLANS. BECAUSE THE PLANS ARE EXPERTLY CONCEIVED, THE CHANCES OF RECEIVING ADEQUATE FINANCING AND ACHIEVING ECONOMIC VIABILITY ARE SUBSTANTIALLY INCREASED.

FINANCING IS ANOTHER IMPORTANT LINK IN THE CHAIN OF SUCCESS. CAPITAL FROM MORE CONVENTIONAL SOURCES SUCH AS VENTURE CAPITAL COMPANIES AND BANKS IS OFTEN NOT AVAILABLE FOR NEW HIGH TECHNOLOGY COMPANIES DURING THEIR FORMATION AND EARLY DEVELOPMENT STAGES. BECAUSE OF THIS, THE MINNESOTA SEED CAPITAL FUND HAS BEEN CREATED, WITH AN INITIAL CAPITALIZATION OF $5 MILLION. THE FUND, ALONG WITH MORE CONVENTIONAL SOURCES SUCH AS SBIC'S, VENTURE CAPITAL FUNDS AND BANKS, PROVIDES ENTREPRENEURS THE TOTAL ARRAY OF FINANCING POSSIBILITIES NECESSARY FOR BOTH START-UP AND EXPANSION.

THE TECHNOLOGY LINK IN THE CHAIN OF SUCCESS IS PROVIDED BY BOTH PUBLIC AND PRIVATE ORGANIZATIONS SUCH AS THE MANAGEMENT AND TECHNICAL ASSISTANCE CENTER OFFICE AT THE UNIVERSITY OF MINNESOTA OR CONTROL DATA'S WORLDTECH SERVICES.

EDUCATION AND TRAINING, MARKETING, MANAGEMENT ASSISTANCE AND OTHER SERVICES ARE ALL AVAILABLE AND THROUGH THE MCO MADE READILY ACCESSIBLE TO THE SMALL BUSINESS PERSON.
IN ADDITION TO HELPING TO CREATE NEW COMPANIES, THE NETWORK HAS PROVIDED THE OPPORTUNITY FOR LARGE CORPORATIONS TO CREATE NEW SERVICES -- TO ASSIST SMALL BUSINESSES. AT CONTROL DATA, FOR EXAMPLE, WE HAVE CREATED, IN ADDITION TO THE TECHNOLOGY TRANSFER SERVICE WORLDTECH, WHICH I MENTIONED, VENTURE CAPITAL, DATA PROCESSING, TRAINING AND MANAGEMENT ASSISTANCE SERVICES. TIME DOESN'T PERMIT A DESCRIPTION OF ALL THESE SERVICES EITHER, BUT I WOULD LIKE TO DESCRIBE ONE OF THEM.

CONTROL DATA BUSINESS ADVISORS, INC. WAS ESTABLISHED IN 1980. USING COMPUTER-BASED TECHNOLOGY AND BETTER ORGANIZED DELIVERY SYSTEMS, BUSINESS ADVISORS IS ABLE TO FURNISH SMALL BUSINESS CLIENTS A LEVEL OF PROFESSIONAL MANAGEMENT COUNSEL WHICH HAS HERETOFORE BEEN AFFORDABLE BY ONLY LARGE COMPANIES.

ONE WAY OF ACHIEVING SIGNIFICANT COST REDUCTIONS WITHOUT SACRIFICE OF QUALITY, HAS BEEN TO CREATE A TALENT POOL OF CONTROL DATA EMPLOYEES. THEY ARE LISTED IN A RESOURCE DATA BANK AND MADE AVAILABLE FOR CONSULTING ON A PART-TIME BASIS. THE PROGRAM IS BASED ON THE FACT THAT MANY INDIVIDUALS WITH TALENTS BEYOND THOSE CALLED FOR IN THEIR CURRENT JOBS FREQUENTLY GROW STALE DOING THE SAME TASK DAY-AFTER-DAY. THUS TEMPORARY CONSULTING ASSIGNMENTS NOT ONLY MAKE MORE PRODUCTIVE USE OF SUCH INDIVIDUALS, BUT ALSO PROVIDE STIMULATION THROUGH THE CHALLENGE OF VARIED ASSIGNMENTS. MOREOVER, IT IS AN
EXCELLENT MEANS OF GAINING ADDITIONAL EXPERIENCE. TALENT POOL LISTING IS ALSO AVAILABLE TO ANYONE IN THE COMMUNITY INCLUDING RETIRED PERSONS AND UNIVERSITY FACULTY. MANY SUCH PEOPLE ARE AVAILABLE FOR CONSULTING, BUT CURRENTLY DO NOT HAVE THE MEANS OF MARKETING THEIR SERVICES EFFECTIVELY -- ESPECIALLY TO THE SMALL BUSINESS COMMUNITY. THIS TALENT POOL CONCEPT WAS FORMALLY PUT INTO ACTION IN AUGUST 1980. TODAY -- FIFTEEN MONTHS LATER -- THERE ARE MORE THAN 900 PEOPLE WHO HAVE LISTED THEMSELVES -- ONE-THIRD OF THEM FROM OUTSIDE CONTROL DATA.

THERE IS MUCH MORE THAT COULD BE SAID ABOUT BAI OR OTHER NEW CONTROL DATA SERVICES. THERE IS MUCH MORE THAT COULD BE SAID ABOUT THE MCO ITSELF, BUT THE POINT IS, THAT BY WORKING TOGETHER, BUSINESS AND GOVERNMENT HAVE CREATED A CLIMATE WHERE THE BARRIERS HAVE BEEN REMOVED AND TECHNOLOGICAL INNOVATION CAN OCCUR MORE FREELY. EQUALLY IMPORTANT, IN DOING SO WE HAVE SIMULTANEOUSLY CREATED OPPORTUNITIES FOR LARGE COMPANIES SUCH AS CONTROL DATA TO OFFER NEW PRODUCTS AND SERVICES. LET ME JUST LEAVE YOU WITH ONE STATISTIC. IN TWO YEARS THE MCO PROGRAM AND CONTROL DATA PROGRAMS TOGETHER HAVE CREATED 72 NEW COMPANIES AND NEARLY A THOUSAND NEW JOBS.

MPI/CPI/MICROELECTRONICS

NOW LET ME MOVE TO A SECOND EXAMPLE OF HOW TO TRIGGER INNOVATION. THE "JAPANESE THREAT" IN COMPUTERS AND
MICROELECTRONICS IS RECEIVING SO MUCH PUBLICITY THESE DAYS THAT IT IS UNNECESSARY FOR ME TO ELABORATE ON IT. SUFFICE TO SAY PERHAPS THAT MICROELECTRONICS HAS BEEN CALLED THE "OIL OF THE EIGHTIES" -- AND JAPAN MAY WELL BE THE OPEC OF THE EIGHTIES.

WHAT IT AMOUNTS TO IS THAT THE COMPUTER AND SEMI-CONDUCTOR INDUSTRIES ARE FACED WITH A CHALLENGE OF TECHNOLOGICAL INNOVATION LIKE THEY HAVE NEVER FACED BEFORE. THE BARRIERS TO MEETING THAT CHALLENGE ARE NO DIFFERENT: RESOURCE REQUIREMENTS; ACCESS TO TECHNOLOGY; SHORTAGE OF TRAINED ENGINEERS; RESISTANCE TO CHANGE; SHORT TERM VIEW; AVERSION TO COOPERATION;

AT CONTROL DATA WE KNOW FROM EXPERIENCE THAT THESE BARRIERS CAN BE MET AND OVERCOME TO THE COMPETITIVE ADVANTAGE OF EVERYONE.

WE ALSO KNOW HOW HARD IT IS TO BRING COMPANIES TOGETHER. SOME EIGHTEEN YEARS AGO, WE STARTED TO ESTABLISH A COOPERATIVE EFFORT IN COMPUTER PERIPHERAL EQUIPMENT. IT TOOK EIGHT YEARS TO GET THE FIRST PARTNER, NCR. THE REASON WE GOT TOGETHER WAS THAT WE WERE BOTH IN ENOUGH TROUBLE TO SEE THE LIGHT. A FEW YEARS LATER, WE WERE ABLE TO PUT TOGETHER ANOTHER JOINT VENTURE WITH HONEYWELL, KNOWN AS MPI, TO DESIGN AND PRODUCE MAGNETIC DISK MEMORY DEVICES. THESE JOINT VENTURES ARE NOT MARKETING COMPANIES. THEY ARE RESEARCH, DEVELOPMENT AND MANUFACTURING
COMPANIES. THEY SELL ONLY TO THEIR PARENT OWNERS. THE PARENTS USE THE PRODUCT OFF-TAKE IN THEIR OWN WAYS, IN THEIR OWN PROPRIETARY SYSTEMS. IN THE CASE OF CONTROL DATA, WE ALSO SELL THEM TO OTHER ORIGINAL EQUIPMENT MANUFACTURERS, INCLUDING MANY SMALL SYSTEMS COMPANIES WHO THEREBY CAN ALSO PARTICIPATE IN THE ECONOMIES OF SCALE WHICH MPI ENJOYS. THE MARKET VALUE OF MPI'S ANNUAL SHIPMENTS THIS YEAR WILL BE 72 BILLION DOLLARS. THE SHARED R&D FREES PRECIOUS DOLLARS FOR THE PARENT COMPANIES TO SPEND ON VALUE-ADDED PRODUCTS AND SERVICES WHICH PROVIDE THEM MARKETPLACE DIFFERENTIATION. THE SHARED PRODUCTION YIELDS ECONOMIES WHICH RAISES GROSS MARGINS OF THE PARENTS. AND THOUSANDS OF SMALL COMPANIES HAVE ACCESS TO LOWER COST, STATE-OF-THE-ART COMPUTER PERIPHERALS. YOU CAN'T FIND A MUCH BETTER SUCCESS STORY THAN THAT.

NOW THE COOPERATION NEEDED IN MICRO-ELECTRONICS IS FAR BROADER AND MORE COMPLEX THAN THAT WHICH LED TO THE FOUNDATION OF CPI AND MPI, BUT THE PRINCIPLES ARE NONETHELESS VALID. THE NEEDED COOPERATION CAN BE ACHIEVED.

ONE FINAL EXAMPLE SHOULD SUFFICE TO DEMONSTRATE THAT CHALLENGE OF TECHNOLOGICAL INNOVATION CAN BE MET.

EDUCATION: I MENTIONED A FEW MOMENTS AGO THE IMPOSSIBILITY OF MEETING OUR EDUCATIONAL NEEDS THROUGH TRADITIONAL METHODS. AT CONTROL DATA ONE OF OUR MAJOR PROGRAMS HAS TO DO WITH THE NEED
FOR INNOVATION IN THIS AREA. THE ONLY PRACTICAL WAY TO MAKE SIGNIFICANT PROGRESS IS THROUGH THE USE OF TECHNOLOGY. TELEVISION, AUDIO/VIDEO TAPES, TELEPHONE AND SATELLITE TRANSMISSION -- ALL COORDINATED IN A NETWORK LEARNING SYSTEM WITH COMPUTER-BASED EDUCATION.

CONTROL DATA HAS BEEN ENGAGED IN DEVELOPING SUCH A SYSTEM FOR THE PAST 19 YEARS. IT'S CALLED THE PLATO COMPUTER-BASED EDUCATION SYSTEM. THE EFFORT HAS INCLUDED SCORES OF COOPERATIVE PROJECTS WITH GOVERNMENT, UNIVERSITIES, LARGE COMPANIES, SMALL ORGANIZATIONS AND INDIVIDUALS. MOST OF THE INITIAL FUNDING CAME FROM THE NATIONAL SCIENCE FOUNDATION IN SUPPORT OF A COOPERATIVE PROJECT BETWEEN THE UNIVERSITY OF ILLINOIS AND CONTROL DATA. AFTER APPROXIMATELY $25 MILLION IN GOVERNMENT FUNDING, FEASIBILITY HAD BEEN VERIFIED. SINCE THEN, MOST OF THE FUNDING HAS BEEN PROVIDED BY CONTROL DATA.

THE PLATO SYSTEM HAS BEEN PROVEN COST-EFFECTIVE IN MANY FIELDS, INCLUDING VOCATIONAL TRAINING AND THE TEACHING OF BASIC SKILLS -- AND WE ARE CONFIDENT COMPUTER-BASED INSTRUCTION WILL PENETRATE VIRTUALLY EVERY AREA OF EDUCATION AS MORE COURSEWARE BECOMES AVAILABLE AND THE GREATER USE OF ELECTRONIC COMPONENTS CONTINUES TO PUSH COSTS DOWNWARD.
ONE OF THE MOST SUCCESSFUL APPLICATIONS OF THE SYSTEM THUS FAR HAS BEEN ITS ABILITY TO HELP MEET THE SPECIAL NEEDS OF THE DISADVANTAGED. FAIR BREAK IS WHAT WE CALL A PROGRAM DESIGNED TO GIVE DISADVANTAGED YOUTHS THE TRAINING NECESSARY TO HELP THEM FIND AND KEEP A JOB. MORE THAN FIFTY FAIR BREAK CENTERS ARE NOW OPERATING THROUGHOUT THE COUNTRY: EACH CENTER DELIVERS INNOVATIVE TRAINING IN BASIC SKILLS, JOB READINESS, LIFE MANAGEMENT AND JOB-SEEKING SKILLS. STUDENTS ALSO WORK PART-TIME IN ORDER TO HAVE A SOURCE OF INCOME AND TO HELP IDENTIFY PROBLEMS WHICH SHOULD BE RESOLVED BEFORE THEY ATTEMPT FULL-TIME EMPLOYMENT. THE PROGRAM IS DELIVERED IN COOPERATION WITH PUBLIC SCHOOLS -- AND WITH FUNDING PRIMARILY FROM CETA. MORE THAN 5,000 STUDENTS HAVE ENROLLED AT THE CENTERS SINCE THEY STARTED TWO YEARS AGO. EIGHTY-THREE PERCENT HAVE SUCCESSFULLY COMPLETED TRAINING -- AND THE JOB PLACEMENT RATE IS NEARLY 80 PERCENT.

IV. THE ROLE OF THE BOARD. THE EXAMPLES I'VE CITED -- THE MINNESOTA NETWORK, MPI/CPI, AND PLATO COMPUTER BASED EDUCATION -- DEMONSTRATE THAT BARRIERS TO TECHNOLOGICAL INNOVATION CAN BE OVERCOME. THE EDUCATION ESTABLISHMENT HAS RESISTED CHANGE -- BUT WITH UNIVERSITY, GOVERNMENT AND BUSINESS COOPERATION PLATO IS MAKING INROADS. BUSINESSES ARE RELUCTANT TO UNDERTAKE COOPERATIVE VENTURES -- BUT MPI IS A THRIVING COMPANY. THE CLIMATE FOR SMALL BUSINESS HAS BEEN WORSENING FOR YEARS -- YET
BUSINESS, UNIVERSITIES AND GOVERNMENT AGENCIES IN MINNESOTA HAVE WORKED TOGETHER TO REMOVE BARRIERS TO THE INNOVATIVE CONTRIBUTIONS OF SMALL BUSINESS, AND THERE ARE ADDITIONAL EXAMPLES THAT COULD BE NAMED. SO THE BARRIERS TO TECHNOLOGICAL INNOVATION CAN BE OVERCOME.

WILL THEY? WILL WE MEET THAT CHALLENGE? FUNDAMENTALLY, IT'S NOT A QUESTION OF PERFORMANCE BY ENGINEERS, SCIENTISTS AND INVENTORS. NOR IS IT A PASSIVE ISSUE -- ONE OF WAITING FOR BENEFITS TO BE BESTOWED BY SOME NEW FISCAL, MONETARY, OR REGULATORY POLICY. AT THE HEART OF THE MATTER IS THE LEADERSHIP OF THE BOARDS OF DIRECTORS OF AMERICA'S MAJOR CORPORATIONS.

ONLY IN THE BOARD ROOM CAN THE NECESSARY ENVIRONMENT AND POLICIES BE ESTABLISHED WHICH WILL ALLOW THE NECESSARY ACTIONS TO BE TAKEN. EQUALLY IMPORTANT, DIRECTORS MUST PLAY A LEADING ROLE OUTSIDE THEIR COMPANIES IN ORDER TO GENERATE SUPPORT FOR THE NECESSARY CHANGES. IN SHORT, DIRECTORS MUST FOSTER THE CREATION OF A NEW BUSINESS CULTURE.

THE OLD CULTURE CONSISTS OF AN ADVERSARIAL RELATIONSHIP BETWEEN INDUSTRY AND GOVERNMENT...OF MINIMAL COOPERATION AMONG COMPANIES...OF AN EMPHASIS ON LOW-RISK, QUICK-PAYOUT INVESTMENTS... AND OF A PREDILECTION BY THE BOARD FOR DWELLING
ON CORPORATE GOVERNANCE AND ACCOUNTABILITY. IN A SMALL NUMBER OF COMPANIES, DIRECTORS DO OVERSEE LONG-RANGE STRATEGY, AND SOME BOARDS DO PARTICIPATE BY SERVING ON COMPENSATION, RESEARCH, PUBLIC AFFAIRS, AND OTHER COMMITTEES. BUT FOR THE MOST PART, CORPORATE GOVERNANCE IS PRIMARILY A MATTER OF MONITORING PERFORMANCE.

IN THE NEW CULTURE, DIRECTORS WOULD PRIMARILY BE RESPONSIBLE FOR CATALYZING CHANGE ...AND WOULD DO SO BY INSTITUTING A SERIES OF POLICIES DESIGNED TO ENCOURAGE INNOVATION. HOW WOULD THAT BE DONE?

POLICIES FOR STIMULATING INNOVATION: LET ME BEGIN BY NOTING THAT TWO MAIN OBJECTIVES MUST BE CONSIDERED WHEN DEVELOPING POLICIES TO ENCOURAGE INNOVATION: FIRST, THE NEED TO KEEP THE CURRENT BUSINESS GROWING PROFITABLY AND SECOND, THE NEED TO INNOVATIVELY ADDRESS SOCIETY'S MAJOR UNMET NEEDS. AS TIME PASSES, IT WILL BE SEEN THAT THE TWO WILL OVERLAP TO AN INCREASING DEGREE.

ONE PART OF THE POLICY WOULD REQUIRE SEMI-ANNUAL REVIEWS OF THE COMPANY'S NEED FOR INNOVATION AND THE ACTIONS BEING TAKEN TO ACHIEVE IT. IT'S IMPORTANT IN THIS REGARD TO DISTINGUISH BETWEEN RUN-OF-THE-MILL INNOVATION AIMED AT IMPROVING EXISTING PRODUCTS AND SERVICES AND INNOVATION ADDRESSING NEW ONES.
IS THE LATTER THAT IS THE SUBJECT OF THIS PROPOSED POLICY.
BECAUSE SUCH INNOVATIONS ENTAIL GREATER RISK AND GREATER COST,
COMPLETION DATES ARE MUCH MORE DIFFICULT TO ESTIMATE.
THEREFORE, THE POLICY MUST PROVIDE FOR A PERIODIC REVIEW AND
ADJUSTMENT OF THE BUDGET...AND, SUBJECT TO BOARD APPROVAL,
ANNUAL BONUS PLANS AS WELL.

IDENTIFYING THE NEED FOR MAJOR INNOVATION CAN BE PARTICULARLY
DIFFICULT FOR A HIGHLY SUCCESSFUL BUSINESS. MOST EXECUTIVES
AND DIRECTORS IN A LARGE COMPANY ENJOYING GREAT SUCCESS HAVE
DIFFICULTY PERCEIVING THE WARNING SIGNS OF A MAJOR SETBACK.
THE TACTICS OF THE AUTOMOBILE INDUSTRY OVER THE PAST FIVE YEARS IS A
GENERAL MOTORS, FORD, AND CHRYSLER ARE CLASSIC EXAMPLES IN
WHICH THE NEED FOR MAJOR INNOVATION WAS EITHER NOT PERCEIVED OR
NOT GIVEN ENOUGH CREDENCE UNTIL TROUBLE WAS ON THE DOORSTEP. A
POLICY REQUIRING A SEMI-ANNUAL REVIEW OF EXISTING INNOVATION
AND THE NEED FOR MAJOR NEW INNOVATIVE EFFORT, IF FAITHFULLY AND
FORCEFULLY IMPLEMENTED, WOULD CERTAINLY HELP AVOID THE AUTO
INDUSTRY TYPE OF CATASTROPHE.

A POLICY FOR INNOVATION IN NEW FIELDS WOULD ALSO AUTHORIZE A
SPECIAL ANNUAL BUDGET. THIS BUDGET WOULD ALLOW EXPLORATION OF
BUSINESS OPPORTUNITIES IN UNMET NEEDS OF SOCIETY THAT ARE NOT
LIKELY TO BE PURSUED AS PART OF THE COMPANY'S MAINSTREAM
BUSINESS. THE BUDGET WOULD BE FOR PROGRAMS WHERE ONE OR MORE
OF THE FOLLOWING CONDITIONS ARE PRESENT: A LONG PERIOD OF
DEVELOPMENT IS REQUIRED, ACCOMPLISHMENT IS UNCERTAIN, OR THE ULTIMATE SIZE OF MARKET CAN'T BE PERCEIVED OR APPEARS TOO SMALL COMPARED TO REVENUES FROM EXISTING COMPANY PRODUCTS AND SERVICES.

OBVIOUSLY SUCH INNOVATIONS MUST BE PROTECTED FROM SHORT-TERM CONTINGENCIES. THEY SHOULD BE GOVERNED BY A SEPARATE BUDGET AND BE CONTROLLED BY AN EXECUTIVE NOT RESPONSIBLE FOR THE PRIMARY BUSINESS.

SPECIAL EMPHASIS SHOULD ALSO BE GIVEN TO POLICIES WHICH FOSTER INNOVATION IN THE AREA OF ACCESS TO KNOWLEDGE BY INDIVIDUALS AND SMALL COMPANIES. SUCH INNOVATION IS KEY TO IMPROVED PRODUCTIVITY. EVERY LARGE CORPORATION HAS EXTENSIVE LATENT RESOURCES WHICH, IF USED CREATIVELY, COULD HELP INDIVIDUALS AND SMALL COMPANIES, AND ALSO ENLARGE PROFITS. AT THE SAME TIME, THE BIG BUSINESSES INVOLVED WOULD BE CREATING A FAVORABLE ENVIRONMENT FOR INNOVATION WITHIN THEIR OWN ORGANIZATIONS. MANY EMPLOYEES WOULD BE STIMULATED TO THINK ABOUT CHANGE AND WOULD THEREFORE BECOME NOT ONLY MORE AMENABLE TO IT BUT ALSO WOULD HELP TO ENGENDER IT.

FOSTERING COOPERATION: IN ADDITION TO POLICIES AIMED AT ENCOURAGING INNOVATION WITHIN THEIR OWN ORGANIZATIONS, DIRECTORS SHOULD INSTITUTE POLICIES TO FOSTER COOPERATION WITH
OTHER COMPANIES AND THE GOVERNMENT. IN MANY INSTANCES THIS IS THE ONLY WAY TO ASSEMBLE THE WIDE VARIETY AND LEVEL OF RESOURCES REQUIRED. THE FIRST POLICY TO BE ADOPTED SHOULD REQUIRE PARTICIPATION IN AT LEAST ONE CONSORTIUM... FOR EXAMPLE, IN A CONSORTIUM ENGAGED IN PROVIDING INDUSTRY-WIDE TRAINING NEEDS. ANOTHER CONSORTIUM IDEA IS ONE FOR URBAN OR RURAL REVITALIZATION. PARTICIPATION FOR A LARGE COMPANY WOULD INVOLVE A MODEST INVESTMENT AND A RELATIVELY SMALL RISK, BUT THE BENEFITS WOULD BE SUBSTANTIAL REGARDLESS OF THE COMPANY'S LINE OF BUSINESS.

FIRST OF ALL TRAINING AND RE-TRAINING COSTS PLAGUE EVERY INDUSTRY AND AS INDICATED ARE A ROOT PROBLEM TO BE SOLVED IN INCREASING INNOVATION AND IMPROVING PRODUCTIVITY. COOPERATION RATHER THAN DUPLICATION HAS OBVIOUS BENEFIT TO ALL.

THE REVITALIZATION OF AN URBAN OR RURAL AREA LEADS TO INCREASED ECONOMIC ACTIVITY OVER A WIDE FRONT. THUS IT GENERATES NEW OPPORTUNITIES TO SELL EXISTING PRODUCTS AND SERVICES. MOREOVER, SINCE THE REVITALIZATION PROCESS WILL INvariably INVOLVE USE OF EMERGING TECHNOLOGIES, THE CORPORATIONS INVOLVED WILL BE AMONG THE FIRST TO DISCOVER OPPORTUNITIES FOR NEW PRODUCTS AND SERVICES.
ASIDE FROM DIRECT ECONOMIC BENEFITS THOUGH, COMPANIES WILL ALSO PROFIT FROM THE EXPOSURE OF TOP EXECUTIVES TO THE HUMAN PROBLEMS FESTERING IN POVERTY-STRICKEN AREAS. UNTIL YOU ARE PERSONALLY INVOLVED IN ADDRESSING THEM, YOU CAN'T REALLY GRASP HOW PERVERSIVE, WIDESPREAD, AND DANGEROUS THEY ARE. HIGH UNEMPLOYMENT RATES AMONG DISADVANTAGED YOUTHS, MUSHROOMING CRIME STATISTICS, AND DATA REGARDING THE MILLIONS OF PEOPLE LIVING BELOW THE FEDERAL POVERTY LEVEL JUST DON'T COMMUNICATE THE DEGREE OF SERIOUSNESS. FOR THE MOST PART, WE DON'T FEEL THE EFFECTS IN OUR DAILY LIVES. CONTINUING TO IGNORE THE NEEDS OF THESE PEOPLE, HOWEVER, WILL ASSURE US THE OPPORTUNITY TO SHARE THE FRIGHTENING CONSEQUENCES OF CRIME IN OUR OWN NEIGHBORHOODS AND A DAILY FEAR OF PERSONAL SAFETY.

GIVEN AN AWARENESS OF THE PROBLEMS, MOST EXECUTIVES WOULD LIKE TO DO SOMETHING ABOUT IT. BUT THEY DON'T KNOW HOW OR DO NOT HAVE ENOUGH INFLUENCE TO REDIRECT CORPORATE RESOURCES. THE CONSORTIUM APPROACH OFFERS THE ANSWER.

V. CONCLUSION

TECHNOLOGICAL INNOVATION HAS BEEN THE WELL SPRING OF OUR ECONOMIC GROWTH. TODAY, WHEN MOST OF THE EASY THINGS HAVE ALREADY BEEN DONE, WE NEED TO MOVE ON TO THE MORE CHALLENGING NEEDS OF OUR SOCIETY. IF WE ARE TO SUCCEED IN THAT, TECHNOLICAL INNOVATION MUST OCCUR ON AN UNPRECEDENTED SCALE.
IN OUR COMPANIES, THERE IS A WEALTH OF TALENT WAITING TO
RESPOND. IN OUR SOCIETY, THERE IS A POTENTIAL LABOR FORCE WHICH CAN BE PUT TO THE TASK. WHAT IS NEEDED IS LEADERSHIP -- AND THAT MUST COME FROM AMERICA'S MAJOR CORPORATIONS. THE CHALLENGE IS OURS. THE REWARDS OF MEETING IT WILL BE EVERYBODY'S.

THANK YOU.