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STATEMENT OF

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BEFORE THE

SUBCOMMITTEE ON INVESTIGATIONS
AND OVERSIGHT

COMMITTEE ON SCIENCE AND TECHNOLOGY

ON

"AUTOMATION IN THE WORKPLACE, ITS IMPACT ON THE LABOR FORCE, AND THE ROLE OF LABOR MARKET PLANNING FOR POLICYMAKING"

Mr. Chairman and members of the Subcommittee, thank you for this opportunity to discuss automation in the workplace and its impact on the labor force. It is clear the Subcommittee has particular concerns about our ability to forecast the impact of automation on such labor problems as worker displacement, skills shortages, and geographic dislocations. Forecasts are an essential tool in developing Government policies and programs for education, technical training, and retraining to remedy these problems. If we fail to understand how our labor markets function, consequent policies and supporting programs could at best be ineffective, or at worst exacerbate the very problems we are trying to correct. Unfortunately, understanding labor markets in a nation as complex as ours is not easy.

In my statement today, based on GAO's past and ongoing work, I will focus on:

--The importance of automation to productivity and the economy,

Barriers and stimulators to the rapid diffusion and use of automation,

--The potential impact of automation on the work force, and

--The difficulties of labor market planning.

IMPORTANCE OF AUTOMATION TO PRODUCTIVITY AND THE ECONOMY

A key factor in productivity and economic competitiveness is automation. Our nation's lag in implementing automation when compared with other industrial nations is reflected in part by our declining productivity and international market performance.

Americans have become deeply concerned about the productivity and competitiveness of our manufacturing industries. They recognize that imports now pervade our marketplace, once the almost exclusive province of American manufacturers. Yet, the profusion of foreign-made automobiles, calculators, refrigerators, and cameras, are only the most visible signs of this foreign penetration. What is particularly ominous is the prospect that further losses in the producer goods market--such as machine tools, robots, computers, and integrated circuits--could signal, in the not too distant future, an over reliance on foreign producers for automation systems and

components which are now the lifeblood of our manufacturing base, and especially, our defense industrial base.

One way American manufacturers could potentially raise productivity and product quality significantly is by coupling families of manufacturing technologies into integrated, flexible systems. If the use of these systems were to then spread quickly throughout our industrial base, in both producer and consumer goods, we could once again become competitive. The Japanese have made significant strides in this area. "Integration" is the key to ultimate success here because traditional organizational and operating structures of the manufacturing firm would be completely changed. There are roughly 400,000 manufacturing establishments in America that could benefit by adopting integrated manufacturing systems.

Because widespread use of automation technology would help us competitively, automation is a desirable economic goal. Unfortunately, however, automation is a double edged sword, for while it can help our competitiveness, it can also hasten and exacerbate our employment problems. Still, we must be realistic in our expectations of how rapidly and how effectively these sophisticated systems are likely to be put into place, and, based on these judgments, what the impact will be on the work force.

BARRIERS AND STIMULATORS OF AUTOMATION

Today, serious impediments exist in this country in the development and integration of automation technology. These impediments directly affect the rate of technology diffusion and the effectiveness of automation systems; in turn, they will

moderate or exacerbate automation's impact on the work force. In general, the impediments fall into four categories--technical, financial, organizational, and social.

Technological impediments center around the incompatibility of the machinery and programs, usually referred to as the hardware and software. Until compatibility is achieved, the many diverse components cannot be integrated into efficient manufacturing processes. The present dearth of engineering talent working on these technological impediments suggests that fully integrated systems are still well off into the future.

Moreover, current market practices by component makers tend to discourage integration. These manufacturers often make their components unique rather than compatible in order to gain an assured market niche. Such actions, of course, delay rather than foster the standardization of automated systems.

Meanwhile, the roughly 400,000 manufacturing firms that could benefit from integrated systems are being provided only components--robots, numerically controlled machine tools, microprocessers, computer-aided design--not systems. Integration, if done at all, must be done by the users who typically lack the engineering talent to design and integrate their own systems.

Consequently, the quantum productivity improvements expected from integrated systems are not now taking place. Instead, firms are making incremental improvements, but none that would ensure

long-term productivity improvement.

Financial and market barriers are those which discourage investment in automated devices, such as

--high interest rates,

--the tendency of businesses to focus on short-term needs,

--uncertainty of the marketplace, and

--other capital investment considerations such as cash flow cost recovery, and the risks inherent in new, untried equipment.

The investment objective of many companies is to recoup the cost of equipment in less than 3 years--much too short a time frame to adequately assess long term benefits of automation. In addition, well designed, integrated systems involve major investments of capital which may be beyond the realistic hope of most small and medium size firms. Their cash flow positions, which are crucial in the decision to invest, simply cannot sustain these extraordinary investments. Moreover, rapid technological change may render these systems obsolete in relatively short periods of time. In times of such great market uncertainty, these small and medium firms thus face the prospect of never being able to recover the cost of the systems.

We use the term organizational barriers to distinguish between today's tradition-bound manufacturing organization and tomorrow's factory of the future. Today we see tightly compartmentalized departments for designing, manufacturing, marketing, purchasing, distributing, accounting, and all the other functional operations. Fully integrated automated systems, on the other hand, means that the organization itself will be

integrated, eliminating several tiers of the traditional structure, and streamlining the middle management and overhead areas in particular. Generally speaking, current manufacturing firm managements do not yet view automation in this light, and there are few, if any, models for them to emulate.

Finally, the social barriers are based on human resistance to change. For example, a union may be apprehensive about the impact of automation on its members and may attempt to protect them through restrictive labor-management contract clauses. Even top managers themselves may be apprehensive about using new equipment or of installing new systems because of the changes that might follow. Initial consumer resistance to automatic checkouts at supermarkets and to electronic funds transfers demonstrates our basic mistrust of automation. But, these examples also demonstrate that through persistence, human resistance can be overcome and technological advances continue.

Despite these barriers to automation, however, the magnitude of our national economic problems--rising labor costs, decreasing competitiveness, shrinking market shares--is forcing us to turn to technology as a way of regaining productivity and market share. These conditions will likely continue to stimulate both development and use of automation technology.

POTENTIAL IMPACT ON THE WORK FORCE

But what is the potential impact of this automation on the work force? To assess this we must address two questions which I alluded to earlier: (1) how rapidly will automation spread? and (2) how sophisticated and integrated will these automated systems

be? Slow, incremental installation of individual components, such as robots and numerical control equipment, will probably moderate any employment impact. On the other hand, sophisticated, fully integrated systems may radically change the employment picture. However, because these integrated systems are very expensive and the talent needed to design, install, operate, and service them is scarce, it is unlikely we will feel severe impact on the labor force for some time.

Thus, available evidence suggests that the impact of automation may be more gradual than popular opinion might suspect. In manufacturing, for example, if fully integrated systems were installed in, say, 10,000 enterprises per year--which would seem to be a very ambitious undertaking--it would still take 40 years to automate our total industrial base.

The concern over whether automation will cause high unemployment is not new. In 1964, the Congress established the National Commission on Technology, Automation, and Economic Progress. One of the main reasons for its establishment was concern over the possible employment impact of computers. The Commission concluded in 1966, that automation would not cause severe unemployment over the next 10 years. We can now all attest to the fact that it did not.

Presently we are witnessing renewed concern because of the expanded uses of automation in virtually all sectors of the economy--uses made possible through microelectronics. Microelectronics has made automation more usable as the computers have become smaller, less costly, and easier to use. One

observer predicts that 40 to 50 percent of all American workers will be using electronic terminals by 1990.

The extent of long term worker displacement caused by automation is the subject of much current debate. There is, however, wide agreement that some short-term displacement and skill shifts are already occurring and will continue to do so. For example, typesetting has become a declining occupation, computer-aided design technology is eliminating the occupation of drafter, and robots are replacing welders, painters and some assemblers in automobile plants.

The key issues for policymakers and, therefore, for forecasters, are (1) whether automation's impact will have the effect of causing long-term structural unemployment and (2) whether shifts in skills for most workers will create higher or lower skill demands. The accuracy of these judgments will largely determine how effective government policies for education, training, and retraining will be.

There is a widespread belief that high technology will require workers to have more sophisticated job skills; therefore, we should upgrade math and science education in our nation's schools. This belief is based on the assumption that first, future job growth will favor professional and technical level jobs--engineers and computer programmers, for example--that require considerable education and sophisticated training. Second, high technology will upgrade the skill requirements of existing jobs because workers in those jobs will work increasingly with technologically sophisticated equipment. And,

indeed, job forecasts for the period 1978 through 1990 indicate that the fastest growing job categories include several high technology occupations--data processing machine mechanics, paralegals, computer systems analysts, computer operators, and office machine and cash register servicers. Based on these forecasts, there is ample reason for policymakers to be concerned about our educational system.

On the other hand, we must also be concerned about another important factor in these forecasts--that is, the total numbers of workers affected as opposed to rates of occupation growth. For example, while the five high technology occupations I just mentioned are forecasted to produce 518,000 new jobs by 1990, five low skilled occupations are expected to increase by about 3 million jobs. These occupations include janitors, nurses aides and orderlies, sales clerks, cashiers, and waiters and waitresses--occupations requiring no more than a high school education.

Thus, the growth in new high technology occupations may not have a major impact on total employment numbers. Still, high technology will probably have a profound impact on many existing jobs in the economy. Secretaries will work with computerized word processing equipment; bookkeepers will use computerized, financial spread sheets; clerks in purchasing and inventory will apply their skills to automated and computerized record systems; mechanics will use diagnostic equipment tied to mini-computers; and telephone operators will rely on computerized directories. But will these kinds of changes require workers with more

sophisticated skills, beyond the initial learning period? This remains a subject of considerable debate.

DIFFICULTIES IN ACCURATE LABOR MARKET PLANNING

Understanding how these changes might come about and the problems they might create is extremely important in labor market planning. Government labor market planning entails identifying potential imbalances in labor supply and demand, publishing that information, and encouraging workers to train for occupations where there are shortages. Generally, planning requires:

--Obtaining information on the labor market (by occupation) and any trends affecting the supply and demand for labor. This includes basic research into how the labor market functions.

--Developing methodologies to forecast supply and demand and then making forecasts.

--Disseminating forecast results to potential users and encouraging their use by education and training agencies in setting up programs.

--Evaluating the impacts of Federal programs on the labor market to improve existing programs or suggest new ones.

Each of these criteria is far too complex to discuss at any length here. But, let me give a brief overview of each, and point out some of the problems relating to them.

Obtaining information about the labor market

Labor market planning requires comprehensive occupational data on national, state and regional levels about both labor supply and demand. One problem in labor forecasting is that relevant supply information is often missing. For example, no centralized single data base is available consolidating information on all current graduates seeking work in a specific occupation. Potential supply of available workers is generally more than the numbers specified in existing data bases. Further, detailed supply information by skill or experience level is virtually nonexistent. In estimating labor supply, one should also examine the substitution or transference of one supply source for another--that is the shifting of workers from one occupation to another.

Current occupational supply is defined as that portion of the labor force attached to a particular occupation and consists of currently employed individuals and the unemployed. When labor forecasts include estimates of labor supply, they generally consider only the current occupational supply. The potential supply--the total number of workers qualified to be in a particular occupation--is not considered. These individuals may be employed in a different occupation, unemployed and seeking work in a different occupation, or not currently in the labor force. More work is needed to better determine how to measure potential labor supply.

Several federally funded education and training programs, in addition to local government and private institutions, affect labor supply. Determining the net addition to labor supply is difficult. For example, CETA, vocational education, and private schools have all trained individuals for the same occupations. In 19 occupations that we examined, these training activities did not routinely provide the training information for forecasting purposes. Thus, each activity could have been contributing to a surplus of workers in a particular occupation and labor market.

Occupational demand, on the other hand, is easier to estimate than labor supply, especially in the short term. Still, errors are made here as well. Since demand estimates must be made by skill level and region, comprehensive surveys of current job openings or vacancies can give a good starting place for forecasting current labor demand. But, as with supply, it is important to break down demand by skill level and experience. For example, a study of high demand occupations in Massachusetts [1]/ found that when many employers spoke of occupational shortages, they were referring to the quality of employees rather than an insufficient number of workers in the occupation. This

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1/ "An Analysis of Selected High Demand Occupations: Findings From a Statewide Survey," Massachusetts Executive Office of Economic Affairs, October 1980.

is just one indication where reliable labor market information needed for forecasting and policymaking is not readily available today.

Methodologies to forecast supply and demand

Occupational forecast accuracy depends on the reliability of input data and modeling techniques used. If the data and techniques used are incorrect, forecast errors are to be expected. People using incorrect information may enter a surplus occupation, or they may not train for a shortage occupation. Such factors affecting input data may include, though not be limited to, overly optimistic assumptions in economic forecasts, inadequate labor supply and demand information, lack of knowledge about the interaction of labor supply and demand, and external factors, such as rapid technological change, that disrupt the economy. Aggravating all these input data problems is that the information must be broken down to the State and sometimes local labor markets.

Modeling techniques such as trend extrapolation, employer surveys, econometric models, input-output analysis, or combinations of these have their own strengths and weaknesses. For example, employer trend surveys are inexpensive, but historically unreliable for predicting specific occupations into the future. Econometric models are more accurate but are very expensive since they require large data bases. Cost versus accuracy trade-offs must be made in choosing the technique. Unfortunately, little information is available to the forecaster on which model to use. And because of the dynamic nature of our

economic system, there can be no guarantee of accuracy, no matter which technique is used.

Disseminating Forecast Results And Encouraging The Use Of Forecast Information

Despite the errors that occur, labor market forecasts are indicators of future skill needs, at least on a national basis. While not the sole consideration in the decision making process, forecasts aid national, state and local decisionmakers in targeting resources for training programs. No decisionmaker wants to waste resources in training people for occupations which already have a surplus of qualified workers. Forecasts are also helpful to the public who can use them in selecting occupations to pursue.

Substantial Federal, State and local training funds are involved. Education and training programs represent close to a $200 billion industry in this country. Until recently, the Federal Government spent over $30 billion yearly on higher education and skill training programs. Disseminating labor market information can help improve the effectiveness of these substantial funds. This figure alone indicates the necessity for establishing funding priorities in some rational manner. Labor market planning can be helpful here as well.

Evaluating Federal Programs That Affect the Labor Market

Given the imprecision of labor market forecasting, coupled with the fact that the government does intervene to change the supply and demand for labor, the importance of evaluating the impact of these programs becomes paramount. The Federal

Government performs extensive labor market research and program evaluation through several agencies. While such research and evaluation efforts provide decisionmakers and program managers with important information, many significant questions remain unanswered. The following are just a few examples:

--Are training programs producing the most needed skills, or are they merely displacing other workers? And what becomes of those displaced workers?

--Are training programs producing skills for occupations with high turnover rates. If so, do high turnover rates mean that training programs were inappropriate?

--Do training programs result in income gains? If not, are the programs achieving their intended objectives?

--Are analytical techniques adequate to make sound forecasts and comparisons of the effects of training programs?

--Do major Government programs siphon off scare skills from private industry?

--What is the impact of Government-industry competition for skills on national productivity and price competitiveness of American goods?

In summary, labor market planning is far from perfect, but it is still essential. We need much more and better information about labor supply and demand, particularly as we move toward an era of greater automation. Analytical techniques that might offer greater accuracy also cost more, so that appropriate trade-offs are necessary.

The accuracy of our forecasting depends heavily on economic assumptions--such as unemployment, inflation, and productivity growth. Even modest misjudgements about economic performance can cause large errors in labor market forecasts--for example a 1 percent underestimation of employment, means 1 million more people will be out of work than originally predicted. Thus, realistic assumptions must be made about the economy to give us a better definition of the problems we're trying to solve. At the same time, we need to better understand labor supply and demand interrelationships within these macro economic factors. Much more research will be needed in these areas.

The Nation is undergoing many changes simultaneously that make labor planning even more difficult. For example:

(1) At the time of historically high unemployment, serious skill shortages persist. This paradox does not speak well for our ability to either predict skill shortages, or to remedy imbalances through appropriate policy or program responses.

(2) Geographically, we have seen virtual population explosions in the south and west where many industries have relocated or started. Such major shifts raise questions about government's appropriate response --should training be set up for workers in declining areas in hopes that industry will return, or should policies encourage workers to move with industry. Workers seem quite willing to change jobs, but not to leave their home communities.

(3) Demographically, more women, but fewer teenagers are entering the work force, at once both increasing and decreasing the need for entry level training.

All of these changes, coupled with the technological advances that are being driven by competitive market pressures, increase the importance of reliable labor market information. Today, I have tried to demonstrate that importance. I have also identified a number of problems that will have to be overcome if we are to improve the accuracy of labor market forecasting. However, as I pointed out earlier, the cost of better accuracy may well be disproportionately higher than the benefits gained. The next logical step, therefore, is to decide which data problems we want to solve and then assess the related costs and benefits.