

DEVELOPING HUMAN RESOURCE FOR THE YEAR 2000

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ABSTRACT

The factories of the future in the year 2000 will be designed with programmable automation (PA) technologies which facilitate flexible automation with computer aided design, manufacturing, planning, inspection and quality control, material handling, and computer integrated manufacturing (CIM)) for increasing their productivity, quality, and competitive edge. The impact of this new technology is far reaching as their potential benefits. This paper presents the effects of PA technologies on skill requirements and workforce displacements particularly in manufacturing industries, and propose a plan for developing and training the human resources to match the skill requirements for the factories of the future in the U.S. A survey of current publications from Bureau of Labor Statistics of the U.S. government, and telephone interview of a number of company executives have been the basis of findings presented in this research.

KEYWORDS
IMPACT OF PROGRAMMABLE AUTOMATION ON HUMAN RESOURCE REQUIREMENTS FOR YEAR 2000

INTRODUCTION

American companies driven by competitive forces are trying radically different production strategies using programmable automation. The potential breadth and scale of these strategies are so enormous that the questions of how they will affect us as employees, customers, or citizens is of urgent concern [11]. For more than two decades, foreign made products that meet or exceeded our standards for quality, performance, and style have been flooding the U.S. market. Foreign productivity and ingenuity, along with their low production cost, are now challenging the preeminence of the U.S. industry even in its domestic fronts. In the past decades, a large number of companies have closed their doors and millions of manufacturing jobs have been lost [18].

In recent years, a new revolutionary force of computer driven Programmed Automation (PA) promises greater productivity, improved quality, reduced costs, and more manufacturing flexibility. It ranges from computer aided design to computer integrated manufacturing (Skinner, 1985). Computer aided design (CAD) systems are now used extensively in the manufacturing industry. For example, General Motors Corporation are currently using more than $100 million of CAD systems to support their product design and engineering activities. The computer terminal population in their design and engineering department has grown from 62 in 1980 to 3000 in 1986 and to over 6000 in 1990. During the 1980s computer controlled robots became common in America's workplaces. Robots requiring no coffee breaks, safety regulations, or unions have already replaced some of America's 20 million blue collar workers [4]. Most of the robots have been installed by large manufacturers such as General Motors, John Deere, IBM, Chrysler, Ford Motors, and General Electric, whose managements are willing and able to invest millions of dollars in new technologies. Robots are primarily used in spot welding, spray painting, and other hazardous operations [7].

Automation experts foresee the greatest advantage of computer automation coming from replacing people and paper with totally computer integrated manufacturing [16]. This paper attempts to examine the effects of this new technology on the employment patterns in the United States. The ideas presented in this paper are based upon a number of field interviews, a survey, results from previous case studies, and information from documents published by government and private research organizations as cited in the reference.

DISPLACEMENT OF WORKFORCE DUE TO PA

The adoption of PA technologies has been perceived to be critical to the long-term survival of American industry by many company executives [17]. PA technologies can significantly reduce the labor content per unit of output. It also creates enormous potential for change in the use of workforce. By eliminating specific tasks and by contributing to major changes in manufacturing processes and organization, PA will not only depress the number of jobs available in manufacturing, but also motivate shifts in the mix of personnel and in the tasks sought from employees. PA will directly or indirectly affect all types of personnel - clerical, production, technical, and professional [2]. Whether it will generate increased aggregate national unemployment will depend not only on these displacement effects, but also on other factors such as the level of production volume which depends on consumer demand and foreign competition, economic conditions, and the number and type of individuals seeking jobs [1]. PA will also provide employers with choices about the number and types of workforce they employ. The outcome of those choices will determine future staffing patterns and employment levels in firms and industries. The U.S. automobile industry exemplifies this

situation. During the recession of the mid '70s and the early '80s, the U.S. auto makers laid off a large number of workers. Because of increased use of PA technologies, they are unlikely to hire to prior early 1970s peak level even with increased sales volume in recent years. On the other hand, PA technologies may help preserving many jobs by providing competitive edges to many domestic companies in fighting foreign competition. A study conducted at New York University by Leontief and Duchin, 1984 suggests that given the impact of PA technologies on labor requirements in manufacturing, education, health care, and offices, and given the employment generated by increased production volume and PA equipment and software production, significant increase in unemployment is not likely to occur in this century [10]. The Office of Technology Assessment [14] also shares the view that use of PA technologies is expected to grow at a faster pace, but without large increase in national unemployment during this century. These two studies assume that a strong economy will follow along with increased production volume and reduced foreign imports. But increased growth in foreign imports, foreign sourcing of parts and subassemblies, and rapid implementation of labor saving PA technologies have started depressing local or regional employment at least temporarily in areas dependent on mature industries. The East North Central region of the United States is likely to experience increased labor displacement due to its association with the automobile industry not only because of increased use of PA technologies but also due to increased foreign competition and foreign sourcing of parts and subassemblies [9]. Similarly, projected drastic cut in defense expenditure is expected to slow down defense oriented production resulting in sluggish employment situation in the Western and the South Eastern regions of the United States at least temporarily [4]

CHANGES IN SKILL REQUIREMENTS DUE TO PA

Improved technical capabilities and diminishing costs of PA technologies will undoubtedly increase the use of PA technologies during 1990s. Two types of impact on skills should be considered: (1) changes in the nature of the skill requirements, and (2) the distribution of skill levels [6]. The nature of skill requirements changes when a worker has to interact with a production system in which computers control operations of machines, flow of materials and inspection of jobs, and at the same time communicate with other machines, staffs, and even managers. The distribution of skill levels refers to the changes in the relative numbers of jobs at various levels in the organization and whether such changes will affect personal growth, advancement, and upward mobility.

Production using PA technologies requires at least six different skills: (1) conceptualization or abstract thinking, (2) visualization or ability to develop abstract mental patterns, (3) understanding of the manufacturing process, (4) analytical and statistical inference

capability, (5) verbal communication, and the most important, (6) sense of high degree of responsibility [5].

Instead of maintaining close contact with materials and machines, role of workers will be to monitor the process. The removal of workers from physical contact may go so far as to transfer the workplace from the machine area into a remote control room. This trend will follow in all stages of production from primary processes through fabrication and assembly. Similar trends will occur for other forms of manufacturing jobs such as scheduling, dispatching, expediting, inspection, and materials handling [8].

. With increased computer integration, workers need to understand how the production process fits together, rather than simply working with one of its part. In the past, mechanization resulted in division of labor when the whole work was broken into a series of relatively simple tasks, and each worker was assigned to one of these small task. Often, workers had no idea about how the whole system works . On the contrary, with PA technologies a production worker will carry responsibilities for several stages in the production process and for understanding how all such responsibilities fit together into the whole system. Thus, PA technologies offer an exceptional latitude in designing jobs. However, the distribution of needed skills within a given workforce will depend upon the management policy. This discretionary aspect in the designing of jobs will allow management to maintain and control the distribution of skills to match the desired goals of the organization. In conventional manufacturing, there has been a reasonably broad spectrum of jobs ranging from "entry-level" to those requiring "high degree of skill and proficiency" [3]. Displacement of jobs due to PA technologies is not likely to affect all levels in a plant. The jobs which are the prime target of PA technologies are those which do not require high skills and are of fixed location in nature. While those requiring a high degree of skills, geographic mobility, multiplicity of tools, nonrepetitive tasks, problem solving in relatively unpredictable situations, and continuous use of visual and tactile sensing are difficult to automate. However, with recent development in sensing techniques and expert systems design, these jobs are becoming increasingly vulnerable to PA technologies [9].

NEED FOR CONTINUOUS RETRAINING OF WORKFORCE

Continuous changes in skill requirements due ever improving technology of PA will demand continuous retraining of the nation's workforce. Conventional schooling and traditional training programs will be insufficient to support the need for continuous upgrading of the skill. The technical school and universities across the nation are not currently equipped and capable to meet this needs. Again there exists very little cooperation between universities and companies for meeting the training needs of the workforce of the future. Each individual

company may end up spending a significant percentage of its operating budget in providing training needs of its workforce until a nationwide plan is developed to fulfill this need. Although a large number of training companies are mushrooming all over the country, there is hardly any accreditation procedure or accreditation agencies to certify and monitor the quality of the training programs provided by these providers. Since the goals and missions of most of the universities across the nation is to provide general education, there emphasis is general and not specific, they are not designed to meet the retraining needs of the nation's workforce. On the other hand, individual consultants are to specialized, and too profit motivated to provide the needed training at a reasonable cost. In fact many companies are spending huge sum of moneys in retraining their workforce using specialized consultants to find that the technology has already changed in the mean time. This is particularly true in the area of high tech/ computerized automation.

In perspective of this volatile ever changing nature of PA, a three tier training program may be recommended : Tier 1: training for upgrading of conceptual skill, and analytical skill, Tier 2: improvement of communication and supervisory skill, and Tier 3: upgrading the technical skill related to the specific area of specialization. Tier 1 and tier 2 training programs may be organized by industry-university cooperation. Specific industry such as automobile, steel, electronics through their consortium may develop an ongoing training program in collaboration with nation's universities at various regional training centers. Because of large scale operations, the programs can be very cost effective and of high quality. The Tier 3 training is supposed to be highly specific in nature, and must be trimmed to the needs of a specific industry or a company. They may be provided by specialist consultants through individual contracts on in-house basis. However, a number of national and regional training centers may be developed through trade associations, or professional institutes such as American Society for Quality Control, Society for Manufacturing Engineers, American Production & Inventory Control Society, Institute of Electrical & Electronic Engineers, Institute of Industrial Engineers, and American Management Association. Many of them have already been catering a number of training and certification programs using trained professional as instructors. But such efforts is nothing but a few drops in the bucket and must be expanded significantly in the near future. Besides, the role of individual training consultants must not be ignored. There are thousands of individual consultants who are experts in their area of specialization and can provide in-house on-hand training trimmed to the needs of an individual company. But it is important that there should be some accreditation agency who shall maintain a directory of qualified consultants in each area of specialization through a process of accreditation/certification. The above mentioned professional organizations can and many of them are currently providing such role of accreditation /certification agencies.

SUMMARY AND CONCLUSION

Displacement of jobs will be the principal long-term effects of programmed automation (PA) technologies . PA technologies are designed to reduce labor hours requirement in production. They are sold as labor substitutes. But whether or not the total employment will decline will depend upon many other factors such as changes in foreign competition, foreign sourcing of parts and subassemblies, production volume, and general economic conditions of the country. Slower growth in labor force, increased production volume, and limited use of PA technologies are likely to buoy employment in manufacturing industries in the early 1990s. However, regional and local employment may become depressed in those areas dependent upon mature industries and particularly textile and automotive industries.

The differential growth of occupations due to growth and decline in various industries has a variety of implications for the job market expected through the 1990s. Workers in occupations that are expected to decline in growing industries as well as in declining ones will have potential displacement problems, particularly because of widespread technological changes.

The need for retraining is essential for putting the displaced workers on the job again. The workerforce must be understanding, flexible, and willing to learn and retrain for its own survival. In factories of the future, the employer-employee relationship will require a greater degree of mutual trust than what has been evidenced in the past. Workers are to be given more responsibilities involving expensive equipment and processes. A relationship of trust is reciprocal in nature. Companies in which this mutual trust does not exist are likely to experience difficulties in reaping the benefits of PA technologies.

Given a history of conflict resolution through confrontation rather than cooperation, it is not yet clear how the U.S. manufacturers are going to meet the challenge of PA technologies. To avoid such confrontation, many companies have consciously located their new automated plants in locations where there is no union. A path of confrontation will paralyze the industries. On the other hand, a non union path will bring inequitability in sharing of the fruits of the new technology and lack of protection of workforce from capricious management practice. Therefore, unions and management must sincerely work together to forge the path of programmable automation towards the progress of the nation and the mankind as a whole.

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