

# AN OPERATIONAL FRAMEWORK FOR EDUCATION AND TRAINING IN THE WASTE MANAGEMENT INDUSTRY AND WORKFORCE 2000

Cheryl J. Dobbins  
President  
Basic Technologies International Corporation

## ABSTRACT

Recent demographic studies indicate that the American workforce in the year 2000 will be overwhelmingly comprised of women, minorities and the disabled. In order for the U.S. economy to become increasingly more competitive on an international scale, these individuals will be required to have highly sophisticated technical skills. An innovative action framework is suggested to assure that performance-based education and training will generate the numbers and types of technologically literate personnel needed by the waste management industry.

## INTRODUCTION

Numerous reports have recently been issued which forecast the changing demographics of the American workforce in the context of an increasingly technologically-based society. "Workforce 2000: Work and Workers for the 21st Century" augurs that technical skill development of an increasingly minority and women populated workforce must become a higher national priority (1). Similarly, "The Forgotten Half: Non-College Youth in America" indicates that non-college bound American youth -- at best -- have inadequate guidance and preparation for the present-day workforce (2). Both reports foretell impending catastrophic consequences for the American economy and for our social and political organizations and well being.

In order to make wise decisions about new directions, we should review the lessons of the past. From the mid-1800s to the better part of the 20th century, this country experienced unparalleled growth due in large part to the advent of the steam engine and electric motor. These technological breakthroughs became the basis of the modern factory and mass production which sharply elevated America's industrial productivity. What resulted was a dramatic change in our overall standard of living, thus generating the need for more products and services for every working American. Such phenomenal growth had less to do with increased national productivity and more with an incrementally expanding workforce. The reality was that America became more productive because more Americans were working, in fact over 50 percent of the population (3).

By the 1970s, however, most American markets were practically saturated. Productivity growth, which in years previous had been double-digit, now slowed to a point that industry found itself "pushing" to reach the five percent level. Despite the fact that more women had entered the workforce, less than 40 percent of this population was employed. Inflationary pricing placed many "needed" and "desired" items out of the economic reach of the majority of the population.

As America looked to foreign markets for opportunities and relief, she discovered that many of her products

were uncompetitive because of quality and cost. We were startled to learn that other countries had taken the basic technology which had been developed here and cost-effectively improved it to achieve an international market competitiveness that America lacked. Relieved of the initial costs of research and development and with access to their domestic government subsidies with which to make improvements upon the core product, foreign producers were consistently able to beat Americans to market. Entire sectors of industrial preeminence -- steel, microprocessors, textiles, etc. -- shifted from America to foreign countries.

During the same period, several other American industries have grown and in some instances have even prospered. Those which have experienced sustained growth have new and emerging technologies as their base. The waste management industry is one such industry. What accounts for this phenomenon? Indeed, the waste management industry is not necessarily blessed with omniscient leadership. Rather, its fundamental issues of corporate responsibility, ranging from municipal solid waste to hazardous materials handling, demand immediate and sure action. Moreover, the waste management industry requires much more of its workers than is usually the case of workers in mass production industries. Because of the potential environmental, socio-economic and political impact of every individual and corporate action taken by its personnel, total quality control and assurance are fundamental.

In addition to being able to complete designated tasks, waste management personnel must use sound judgment and be decisive in responding to constantly changing circumstances. Such vigilance in identifying indicators of possible liabilities requires high performance from a most productive work organization. Whether in order to assure personal health or reduce corporate culpability, this industry has embraced the advent of the computer, high-speed communication and universal education as bases of its new work organization (4). The waste management employee must be efficient and effective in this technological workplace.

The waste management industry is directed toward an increased focus on pollution prevention, waste minimization and long-term national clean-up of hazardous and non-hazardous waste sites. An even greater concern is the

growing need for more skilled and trained workers. The Commission on the Skills of the American Workforce report, "America's Choice: High Skills or Low Wages," suggests that the nation is ill-prepared to provide this educated workforce (5).

#### WORKFORCE 2000 AND THE NEW WORKPLACE

The Department of Energy's (DoE) Environmental Restoration and Waste Management (ER/WM) Five-Year Plan and Applied Research, Development, Demonstration, Testing and Evaluation Plan indicate that DoE's ER/WM technical workforce needs alone will increase by 50-70 percent from an estimated 10,000 - 12,000 full-time scientists, engineers and technicians to an estimated 15,000 - 20,000 between FY1990 and FY1995 (6). Yet unclear is the mix in occupational levels and types that will account for this growth.

Figure 1, "ER/WM FY1990 Occupational Skill Mix," indicates that for the DoE, engineering presently accounts for the largest technical occupations in ER/WM. Future estimates, however, indicate that the long-term needs for technicians will grow proportionally faster than the need for engineers. Ten "high use" occupations have been identified in FY1990 by the DoE based on analysis of detailed operational budget estimates:

- chemical engineers
- technicians, other
  - trainers, clerical support, ground radar technicians, lab analysts, drillers, and mining operations technicians
- mechanical engineers
- earth science
  - geology, hydrology, and environmental science
- engineers, other
  - management, cost estimating, instrument, quality assurance, waste processing, architecture, and geological, plant, and structural engineering
- environmental engineers
- scientists, other
  - risk assessment, project leader, soil science, economics, environmental regulation interpretation, and seismic science
- hazardous waste management technicians
- materials handlers
- civil engineers (7)

Embedded in this list are real challenges and opportunities for both the public and private sectors of the waste

management industry. The "other" categories include diverse occupations which, in time, may become independent occupational subsectors. Needed is more specificity regarding the skill mix requirements for scientists, engineers, technicians and managers of both waste management and operations missions. If the DoE estimates prove to have validity for each of these subsets, then similar estimates must be established for the private sector, as well as other federal, state and local environmental technology and waste management employers.

The need for trained personnel, once firmly established in quantitative terms, will require a methodical response mechanism. Increased attention must be paid to the nature of the future labor force in order to determine how, qualitatively, the requisite numbers will be generated.

Figure 2, "New Entrants Into the American Labor Force, 1988-2000," indicates that clearly two-thirds of the U.S. workforce will be comprised of women, minorities and the disabled. This fact poses a most interesting challenge to the waste management industry as well as the nation's educational communities, for these population sectors upon whom both the nation and the industry will rely to provide the competitive edge in waste management technology are comprised of the very persons who, in the past, have not been attracted to science and engineering careers. Moreover, industry views many of these individuals as lacking the education and "skills" for advanced training:

- strong cognitive ability,
- basic mathematical proficiency,
- literacy,
- good work ethic -- reliable, attentive to detail, and
- social - presentable and able to communicate well on the job (8).

Market forces have, in the past, been successful in providing the base of white male talent for education and training in the sciences and engineering to fuel technology-driven industries. However, new strategies must be employed to bring minorities, women and the disabled into that arena so that "normal" waste management market forces can take effect. Moreover, these new approaches must be realized within the context of a national workforce which is itself struggling to find why and how it will cope.

Major workplace changes brought on by technology and an increasingly unpredictable general economy have not always been well received by labor and certain sectors of management. Fewer workers will be required to be more productive. This can only be made possible by the introduction of new technology. Its impact on the workforce will be uneven due specifically to the attitude and preparation of the workforce. Some individuals will discover that the new technology will broaden their job-skill requirements; for

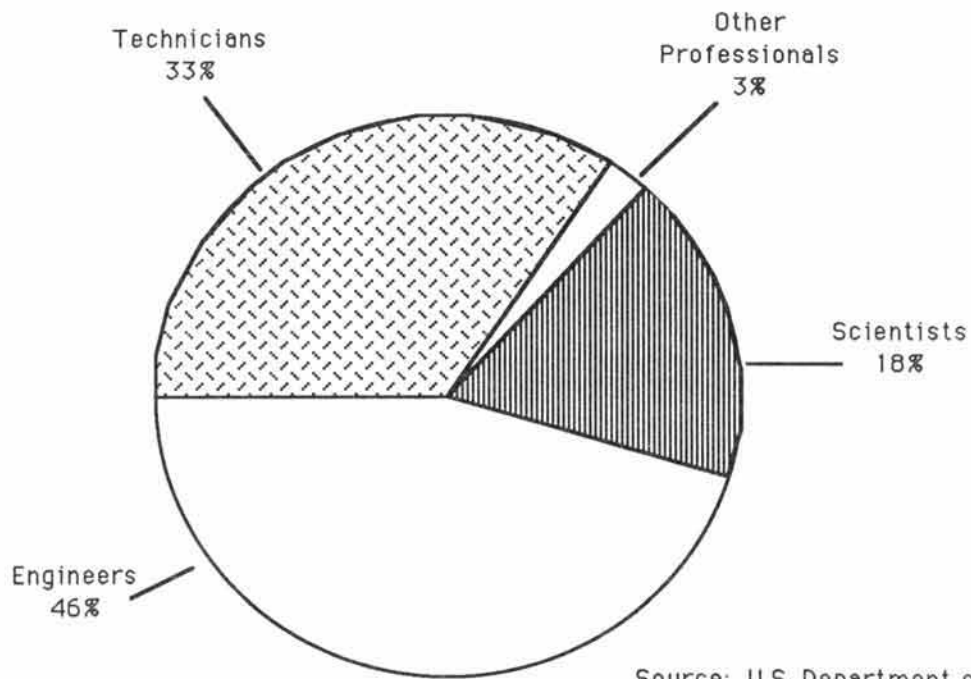


Fig. 1. ER/WM FY1990 occupational skill mix.

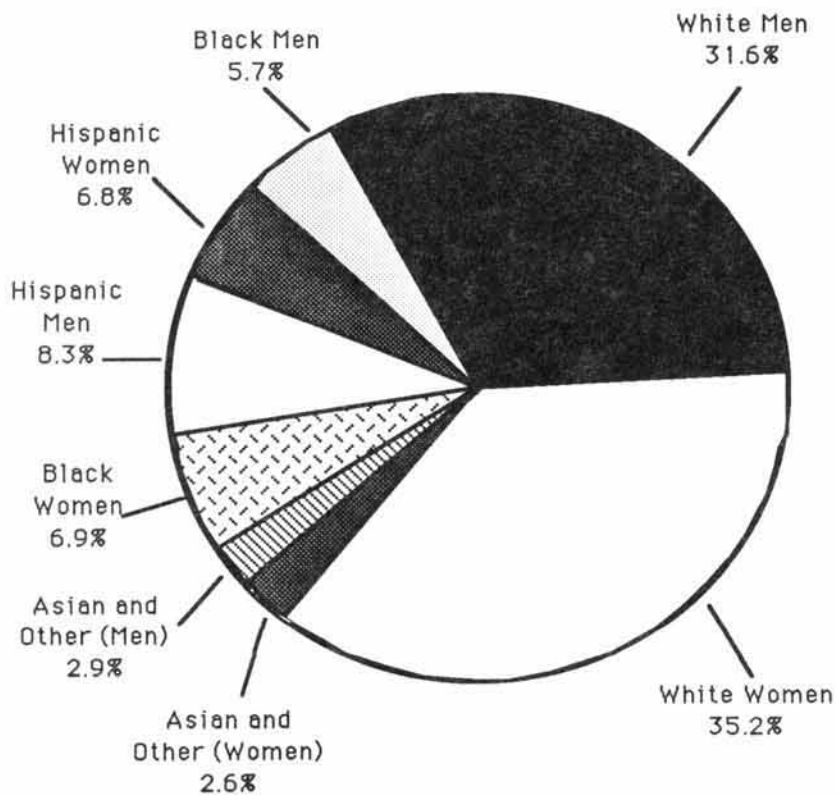


Fig. 2. New entrants into the American labor force, 1988 - 2000.

others, job requirements will be greatly contracted. Inefficient bureaucracies will be relaxed to allow for more direct worker authority in the implementation of a wider variety of technical tasks. This increased "hands-on" access to information will reduce layers of management such that each worker will feel closer to the problem and indeed be closer to the problem-solving. There will be greater pressure to reproduce and disseminate more readily accessible information which identifies when and by whom productivity goals are met.

#### LEADERSHIP OPPORTUNITY FOR THE WASTE MANAGEMENT INDUSTRY

In the Report of The Commission on the Skills of the American Workforce, June, 1990, is the following statement:

"No nation has produced a highly-qualified technical workforce without first providing its workers with a strong general education.... Our frontline workers will not be able to compete in the economic area because they are increasingly unable to compete in the educational arena" (8).

The Environmental Protection Agency (EPA) and the U.S. Department of Energy (DoE), as major public-sector industry employers in waste management, have already exhibited leadership by beginning to grapple with the task of educating and training minorities for the rapidly changing environmental restoration and waste management industries.

In April, 1990, the EPA sponsored a "National Minority Environmental Career Conference" to establish a better dialogue between itself and minority students and minority professionals regarding their limited numbers in the environmental industry -- public, private and private not-for-profit. EPA has also established a Minority Academic Institutions (MAI) Task Force to make recommendations and monitor the agency's success in broadening access by minority students, technologists, researchers and businesses.

Likewise, in October, 1989, the DoE sponsored a three-day working conference on "Math/Science Education Action" at the Berkeley Hall of Science, University of California, Berkeley. Recommendations from that meeting were incorporated into a request for proposals to establish an Academic/Industry Partnership Program in order to begin to implement many of the successful minority recruitment approaches outlined during that meeting. On September 10, 1990, Secretary James F. Watkins announced that his Department had completed its review of national academic competitors. Their decision was to enter into a five-year \$25 million cooperative agreement with the

HBCU/MI Environmental Technology and Waste Management Consortium.

The HBCU/MI Consortium is a group of seventeen leading research-oriented Historically Black Colleges and Universities (HBCUs) and Minority Institutions (MIs) that has agreed to work together to initiate research and education programs to address the nation's critical environmental problems. Its members are well-known for their significant past and current cost-effective contributions in training the nation's minority technical workforce.

The Consortium has developed specific goals and objectives in research and development, policy formulation and minority manpower needs in environmental technology, hazardous, solid and mixed waste materials management; environmental restoration; and environmental health while concomitantly addressing the following constraints:

- limited minority participation in the public, private and non-profit environmental industries;
- limited environmental awareness among minorities;
- minimal interaction between HBCUs/MIs and majority universities, industry and interest groups;
- limited institutional development in environmental education and research; and
- lack of minority technical businesses in the environmental industry.

Its Research, Education and Technology Transfer (RETT) Plan outlines a four-part action strategy of interventions:

- minority outreach and pre-college education
- undergraduate education and post-secondary training
- graduate and post-graduate education and research
- technology transfer (9)

The HBCU/MI Consortium has recently proposed a joint DoE-EPA sponsorship of a "National Congress for the Advancement of Minorities in the Environmental Professions" to be held in the spring 1992 to allow both industry and academics to better understand each other's needs and approaches to mobilizing the requisite manpower for the development of future technology. The "Congress," built on the National Governors Association policy development process model, would be invitational and only open to full participation of CEOs and Senior Vice Presidents of national waste management companies that have established track records in environmental restoration, environmental research/technology development and/or waste management; senior public sector managers (state governors, federal and state departmental secretaries and agency

administrators); and Presidents/ Chancellors of minority academic institutions.

In the interim, representatives from the nation's education, environmental technology and waste management communities will begin to exchange information and ideas on the needs, resources and industry potential to be gained by establishing industry/academic partnerships. This planning process will generate goals and clearly articulated agreements for realistic action plans in which all involved parties can participate.

The HBCU/MI Consortium believes that the action plan of the Commission on the Skills of the American Workforce Report is worthy of further investigation. The Report suggests fundamental changes in America's approach to education and training for work and an operational framework based on the following assumptions:

- High performance must be demanded of all students, including those not going on to college.
- All young people must be assured of the education they need to succeed in the workplace.
- Industry and educators must jointly define standards of professional competence in order to effectively make the transition from school to work.
- Students not going to college and people already in the workforce must be provided the means to acquire, renew and cross-train for the technical and professional skills needed for high productivity.
- Public labor policies must be expanded to promote skills development for all workers.
- Industry incentives must be built-in to promote high quality productivity (9).

Figure 3, "Schematic Representation of the Commission on the Skills of the American Workforce," makes operational the functional definition of educational skills development. The Commission report introduces the concept of a Certificate of Initial Mastery for certifying labor-market readiness and mastery of the basic skills necessary for high-productivity employment. The Certificate would also be required for entry into all subsequent forms of education and training, including college preparatory and certified professional and technical programs.

The Certificate of Initial Mastery would not indicate completion of a student's formal education. Rather, it would show adherence to a nationally established set of standards and assessments to ensure that every student leaves compulsory school, at the age of 16, with a demonstrated ability to read, write, compute and perform at world-class levels in general school subjects -- mathematics; physical and natural sciences; industrial and commercial arts; history; geography; politics and civics; economics; and language arts. For the vast majority of students, this certi-

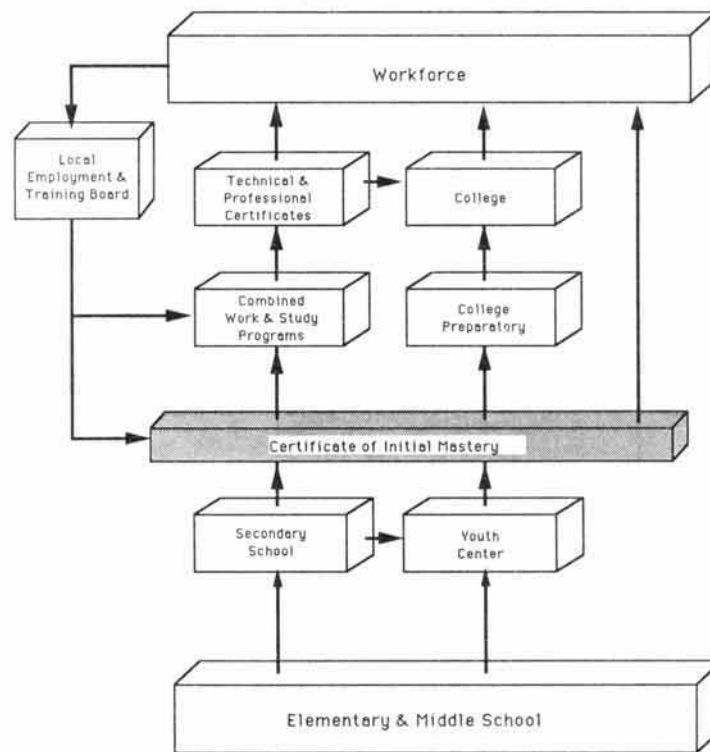
fication would serve as a foundation for more advanced forms of education and/or training.

Certification would result from success at a series of performance-based examinations for which students can explicitly prepare themselves. Such cumulative assessments offer several advantages. Students are organized and motivated for accomplishments of short-term objectives over extended periods of time. Everyone would understand that his or her achievement is paced to their effort in addition to innate ability. Such an approach likewise increases the possibility for success by under-educated and unmotivated students. States would take the responsibility for assuring that those students who are not performing well in the mainstream education system would earn their credentials in alternative learning environments.

In addition to new structures and missions in the education and training continuum offered American students (Youth Centers, Local Employment and Training Boards, etc.), the Commission suggests that new rules and philosophies would also apply. High national performance standards would be accompanied by industry and educational supports to assure that students and adult trainees are able to meet them:

- year-round access to basic education in alternative settings;
- access to employment and career counseling, work experience and job placement;
- industry-sponsored mentoring networks;
- amendment of the child-labor laws to grant work permits to young people under 18 contingent on either the possession of a Certificate of Initial Mastery or enrollment in a program leading to the Certificate;
- restructure pre-school and elementary school preparation to integrate successful child development programs for children in need;
- development of a national incentives program for schools to retain potential dropouts; and
- development of a national program of incentives and assistance for all industry employers to invest in the further education and training of their workers to pursue high forms of work organization (10).

Of particular interest to the waste management industry would be the establishment of a system of Technical and Professional Certificates and associates degrees (see Fig. 3) that would be specifically created for students and adult workers interested in the industry. Industry leaders and educators would build upon existing certification procedures and develop a single coherent and internationally competitive set of assessments to guide career progression



Source: Commission on the Skills of the American Workforce Report

Fig. 3. Schematic representation of the skills of the American workforce.

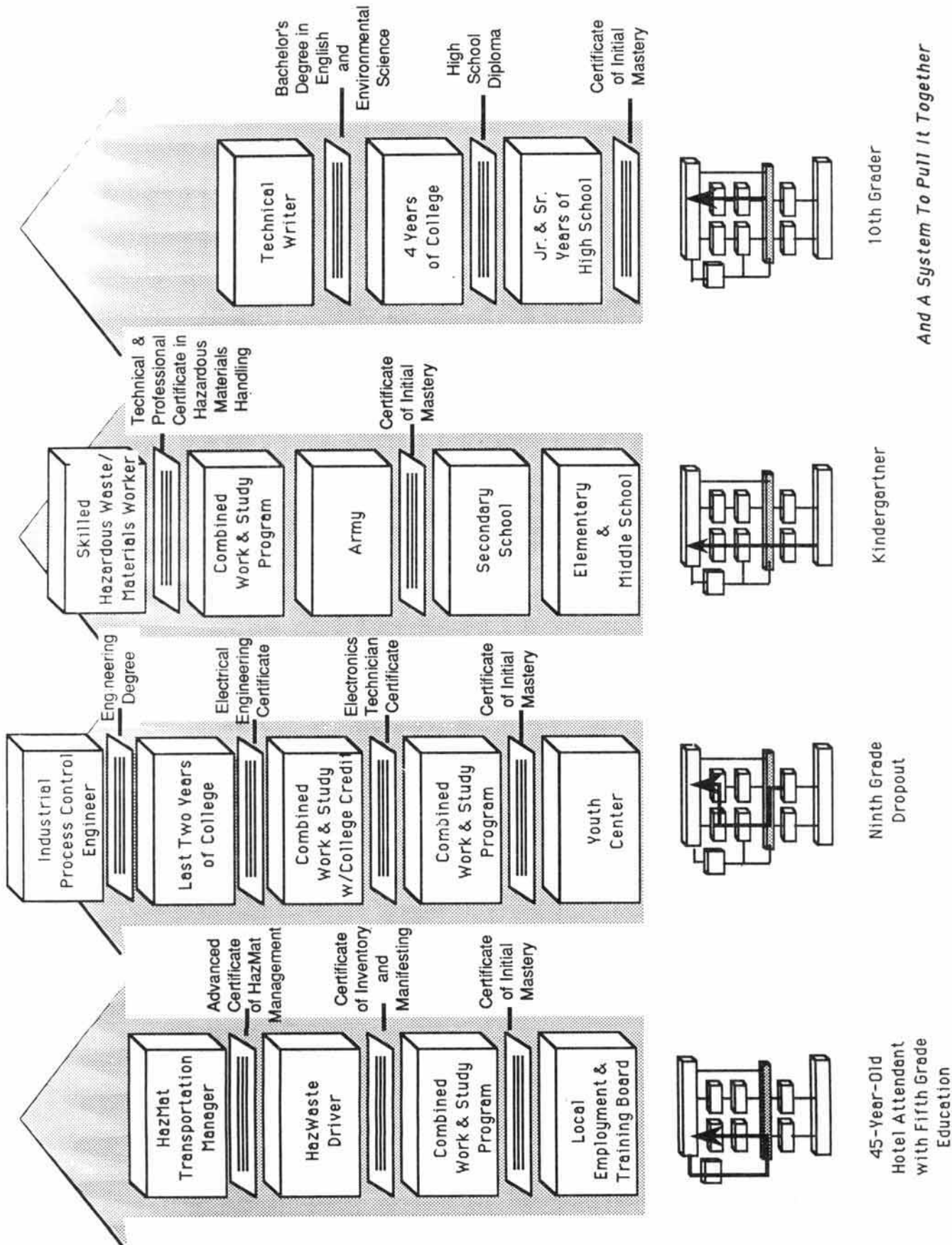
with each environmental and waste management industry sector or trade.

Once appropriate labor standards and other worker safeguards are established, the work component of this approach could provide the waste management industry with trained temporary and part-time workers. Full-time employees would thereby be provided greater job stability, opportunity for cross-training and study as well as greater task diversity. Students would receive valuable work experience, on-the-job mentoring and a base income.

With this model, success can be achieved by any student using a variety of information access routes as demonstrated in the chart above (see Fig. 4). Moreover, its structure is in response to the larger public policy aim of providing a comprehensive system of skills upgrading for the majority of American workers. Using the Commission on the Skills of the American Workforce Report as a guide and the "National Congress for the Advancement of Minorities in Environmental Professions" as a vehicle, the waste management industry is offered the opportunity to take national leadership in assuring a competent workforce for the 21st century. Both the Commission report and the National Congress can provide the initial skills preparation and the school-to-waste management employment of currently minority populations, that is, women, minorities and the disabled which will be the majority workforce in the year 2000.

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Adapted from the Commission on the Skills of the American Workforce Report

And A System To Pull It Together

Fig. 4. Processing through the new structure: four examples for the waste management industry.

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