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ABSTRACT

This paper discusses the economic development challenge to vocational education. It begins with an overview of the dynamic processes of technological change and industrial development and their implications for jobs and training. Several issues are then raised regarding planning, implementation, and evaluation of vocational education programs as they seek to facilitate state and local economic development. Four specific topics are addressed that highlight the importance of making critical distinctions between short-term and long-term economic development: (1) future skill surpluses, (2) customized training, (3) jobs in branch plants versus indigenous new firms, and (4) serving new skills at the expense of the old. Thereafter, the paper poses important research questions that should be addressed in the national assessment of vocational education. The 10 issues are categorized by three major areas: the responsiveness of vocational education to changing labor market needs, balancing short-term and longer-term development objectives, and vocational education and the education and training network. The final section comments on a case study research approach to generate answers to these questions. A six-page reference list concludes the document. (YLB)

VOCATIONAL EDUCATION AND ECONOMIC DEVELOPMENT: THE NEED FOR BALANCE

by
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Shifts in demand and output from older products and industries to those technologically more advanced are inherent the dynamics of production and economic development. Moreover, changes in the occupational mix and spatial location of employment, the skill requirements of industry, and the responsibilities of institutions in training workers are intertwined with technological progress and industrial development. Failure to adapt to these structural changes can result in skill shortages in emerging occupations, falling productivity, pockets of substantial unemployment, and lower economic growth overall.

The Carl D. Perkins Vocational Education Act of 1984 recognizes the evolving nature of industrial change and challenges the vocational education system to assume a greater role than in the past in facilitating state and local economic development. Vocational educators are encouraged to design programs, for example, to prepare workers for new and emerging technologies, to promote the entry of new businesses and industries, to assist in the revitalization of established businesses and industries, and to facilitate the reemployment of workers displaced by technological change or industrial location. The Act's focus on the funding of new and expanding programs, rather than on the maintenance of established programs, further accentuates the trend toward making vocational education more sensitive to changing labor market needs.

This paper discusses this economic development challenge to vocational education. It begins with an overview of the dynamic processes of technological change and industrial development, and their implications for jobs and training. Several issues are then raised regarding planning, implementation and evaluation of vocational education programs as they seek to facilitate state and local economic development. Thereafter, the paper poses important research questions that should be addressed in the national

assessment of vocational education, and comments on a research approach to generate answers to these questions.

PRODUCTION LIFE CYCLES AND THE DEMAND AND SUPPLY OF SKILLS

Recent debates over industrial policy and high technology focus attention on the process of industrial birth, spurts of growth, maturation and decline.[1] The concept that industries pass through a series of stages during their development, however, dates back to the 1930s, when industries were found to undergo a sequence of stages — experimentation, rapid growth, diminished growth and stability or decline — during their industrial "life".[2] More recently, separate "life cycles" have been delineated for products, for production processes, and for technologies.[3]

Technological change, in particular, is found to be the engine behind these dynamic processes. By directly affecting levels of uncertainty, of risks, of standardization and of product demand, the development of technologies influences the timing and shape of product and process cycles. These, in turn, affect the nature and behavior of various industries and firms.

Production Life Cycles and Labor Demand

Production life cycles affect the occupational mix of jobs as well as the level of employment in an area. During the experimentation phase, engineers and scientists are needed to develop new technologies, construct pilot models and implement design changes. These professionals perform most of the tasks later assumed by production and marketing managers, technicians and skilled crafts workers. In addition, the relatively short production runs and general

purpose equipment that characterize the earlier stages of product development require skilled set-up and maintenance workers. Subsequently, the diffusion of technology and large-scale production permits more routinized tasks requiring less-skilled workers who monitor and control the equipment. Product assembly can be done by lower-skilled and unskilled workers who concentrate on a very limited number of specific tasks.[4] Skills, once embodied in the workforce, are transferred to the production equipment. (See Chart 1)

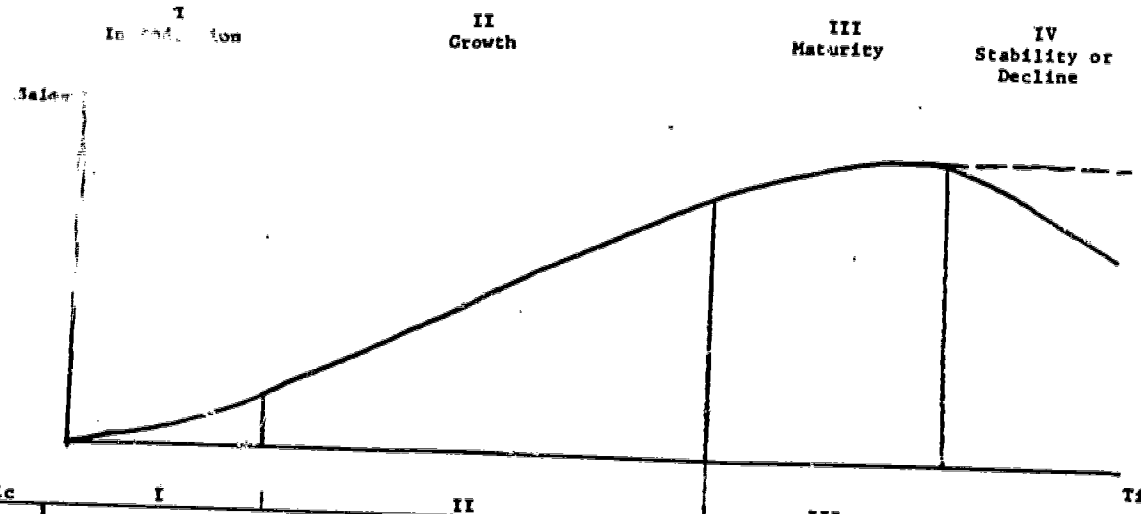
Industrial development also has implications for the spatial patterns of employment. Initially production takes place in close proximity to research and development (R & D) as engineers and scientists experiment with product and process design. At later stages of development more stable production techniques and standardized equipment permit the separation of R & D from production. Manufacturing activities can be transferred to lower-cost regions and countries, as technologies and products mature and competitive advantage increasingly becomes a function of unit production costs.[5]

Training Cycles in Occupational Preparation

In addition to affecting the demand for various skills, technological change influences the supply of workers with the relevant skills, as it triggers "training cycles" in occupational preparation.[6] On-the-job training and other workplace training programs are relied upon to produce the skills required by the introduction of new technologies. The scientific and engineering staff initially teach others what needs to be done for production in small batch jobs. In addition, the skills necessary to operate equipment that has been custom-designed for a specific company must also be acquired at the worksite. The manufacturer of the equipment often provides this training.

Chart 1

PRODUCT LIFE CYCLES, TECHNOLOGY AND JOBS



Characteristic	I	II	III	IV
Products and Product Change[1]	Diverse; Frequent design changes.	Increasing standardization; Declining rate of product innovation.		Standardized
Process Innovation[1]	Exploratory	Relatively high rate; Major innovations	Rate declines	Minor, if any; Refinements.
Process[1]	Job shop; Batch production	Increasingly automated	Mass production	Mass production
Equipment[1]	General purpose	General purpose → Specialized	Specialized	Specialized
Tasks	Complex	Increasingly Routinized		Segmented
Dominant Labor Input	Highly-skilled scientists & engineers	Engineers & technicians → Technicians & semi-skilled production	Semi-skilled & low-skilled production	Low-skilled production
Job Skills	Firm-specific	Increasingly General		General
Skill Training	Acquired at workplace	Shifts to the schools/colleges	Shifts within the educational network.	Varied training sites; Focus on replacement needs and retraining.
Job Structure	Job enlargement	Emergence of new occupations		Established, rigid job hierarchy

[1] William J. Abernathy and James M. Utterback, "Patterns of Industrial Innovation," in Robert R. Rothenberg, (ed.), Corporate Strategy and Product Innovation, 2nd Edition, (New York: The Free Press, 1981,) pp.428-437.

Source: Patricia M. Flynn, Technological Change, Jobs and Human Resource Planning, (Cambridge, MA: Ballinger Publishing Company), forthcoming.

When a technology becomes more widely adopted and equipment standardized, skills that were once "firm-specific" become general skills that are transferable among employers.[7] Because employers cannot capture the return on investments in general skills, they prefer to shift the general training out of the factory and into the schools where it will be paid for by the government or by individual students. Moreover, as demand for such skills increases, it is easier to formalize the training and provide it in the schools. Together these two forces encourage the shift in skill development from the workplace into the formal educational system during the middle stages of the production cycle. Keypunching, word processing training, and the set-up and operation of various numerical control equipment are classic examples of this transfer.

If demands continue to grow, training becomes diffused among a wide range of educational institutions. Finally, as the industry declines and demands for these skills contract, training focuses on meeting the replacement needs of firms and on retraining workers for employment in other fields. Training may be spread in haphazard ways among various educational institutions as training pressures gradually diminish.

VOCATIONAL EDUCATION AND PRODUCTION LIFE CYCLES

As factor availability and market demands differ among geographic areas, technological change and production processes have differential effects on specific states and local communities.[8] Moreover, the attractiveness of states and local economies to industrial sectors at different stages of development varies, suggesting an ongoing, dynamic process of economic growth and development.

Vocational education can facilitate structural change by adapting to the diverse and evolving skill needs of an area. To do so, however, requires a comprehensive set of programs, some of which are aimed at facilitating the transfer of new skill needs from the workplace to the schools, others of which focus on job and worker disruption associated with plant closings, layoffs, and skill obsolescence.

Training for Emerging Skills and High Technology

The expanded focus of vocational education in training for new and emerging fields and for high technology, combined with the more broadly-based trend promulgating high technology as the key to economic revitalization, accentuates the need to better understand and incorporate the dynamic nature of economic development and production processes into vocational education policy. Monitoring growth and decline over the course of industrial development, however, can be difficult. Anticipating new and emerging skill requirements is especially troublesome, as past employment trends and traditional forecasting techniques are not helpful in identifying these labor market needs.

Training for Emerging Skills

The Perkins Act promotes training for emerging skills and occupations. For instance, vocational education is encouraged to train workers in "new and expanding industries" [Section 321(c)(ii)], to help meet the needs of "employers who require assistance in training imdividuals for new employment opportunities or in retraining employees in new skills required by changes in technology, products or processes" [Section 322(b)(1)(A)(v)] and, to develop programs which stress "new and emerging technologies" [Section 251(a)(5)].

Technological change and production processes result in the creation of new skills and occupations.[9] The number of workers needed to perform new tasks, however, is hard to anticipate. Employment projections, frequently used to guide curricular change and program development for job-related skills, generally are extrapolations of past employment trends. As such, they are best able to indicate growth and replacement needs in more traditional industries with relatively stable products and technologies. They are least effective in anticipating "turning points" in employment, training gaps in areas of emerging skill needs, or sudden spurts in employment growth.

The degree of technical competence required by new tasks is also difficult to ascertain. On-the-job training and employer-sponsored training programs are critical for the determination and acquisition of skills required for "emerging occupations". Working in an environment of considerable uncertainty and relatively high risk, scientists and engineers determine new occupational requirements at the workplace on a trial and error basis, and there is often a bias towards higher skills than would be required after initial product development.

Schools cannot hope to prepare workers for emerging skill needs as they first arise at the workplace. However, as a technology develops and as demands for new skills expand, skills become more generalized and transferable among employers. Training can then be formalized and should be transferred to the educational institutions. This skill transfer process requires close, continuing collaboration between schools and employers.

Training for "High Technology"

Part E of the Perkins Act is devoted to training for high technology occupations. In addition, career guidance and counseling grants may be used to assist individuals "to develop new skills to move away from declining occupational fields and enter new and emerging fields in high-technology areas"[Section 332(a)(4)].

Although debate continues over what constitutes the high technology sector, and the quantity and quality of jobs that it can deliver, local communities, states, regions, and nations are actively seeking to attract "high tech" employment.[10] As generally defined, "high technology" employment, includes a list of industries said to be operating at the "cutting edge" of new technologies — industries usually identified by their relatively high proportions of research and development (R & D) expenditures and of professional and technical workers. Most high technology definitions include, at a minimum, the following industries: drugs, office and computing machines, communications equipment, electronics components and accessories, engineering and scientific instruments, measuring and controlling devices, optical instruments and lenses, medical instruments and supplies and photographic equipment and supplies. Depending of the definition used, the proportion of jobs accounted for by high technology industries in the United States is relatively small — ranging from under 2 percent to approximately 8 percent.[11]

Industries in their early "emerging" stage of development, are relatively concentrated geographically.[12] Agglomeration economies with respect to research and development, skilled labor pools and support services are especially important at this stage, particularly for small firms, that lack

the resources and internal capabilities of providing these needs. Small, newly formed firms tend to play their greatest roles during this phase of industrial development as standardization and large-scale production do not give large volume producers significant cost advantages.

While accounting for a relatively small share of employment, "high tech" industries — by definition — do tend to have relatively large proportions of their employment in highly skilled professional and technical jobs compared to other types of industries. Blue collar and clerical jobs, however, continue to account for the majority of the employment in these newer industries. Moreover, there is considerable diversity among high technology industries and occupations with respect to wage levels.[13]

As the previous discussion of production life cycles implies, the concept of a "high technology" industry is misleading. "High technology" is a dynamic and relative concept that describes the early phase of industrial development. Industries, of components thereof, pass through "high tech" phases — characterized by rapid technological change, a relatively high degree of R & D expenditures, and a dependence on highly-skilled workers. While the textile industry is often referred to as mature or traditional, it represented a "high tech" industry a hundred years ago. Similarly, industries considered "high tech" today, such as computers, powered metals, biotechnology, or information processing, may or may not be the "high tech" industries of tomorrow.

Training for Individuals and Employers in Established Occupations and Industries

The attention to new skill requirements clearly needs to be broadly cast. The diffusion of technological change, the rate of which is said to be

increasing in recent years, generates new skill requirements throughout the economy.[14] Manufacturing, non—manufacturing, large firms, small firms, private enterprises, public agencies, new businesses, mature businesses — all are undergoing changes in their employment patterns and skill needs as technologies, such as microelectronics and information processing, change the nature of work. The needs of all of these constituencies are addressed in the Perkins Act.

Re-Training for Upgrading and Promotion

Employed as well as unemployed individuals can benefit from the Perkins legislation. Vocational education is encouraged to provide a wide range of adult training, retraining, and skill upgrading programs — types of programs that are often barred by the low income eligibility requirements imposed on many trainees under the Job Training and Partnership Act (JTPA). The Perkins Act, for example, promotes the provision of skills for "workers who are unemployed or threatened with unemployment as a result of technological change or industrial dislocation [Section 251(a)(6)], assistance to employees "who require retraining to retain their jobs, or who need training to upgrade their skills..."[Section 322(b)(1)(A)(iii)], and help to employers "to assist their existing work force to adjust to changes in technology or work requirements" [322(b)(1)(C)(i)].

The development and introduction of new technologies and new types of equipment create a range of relatively high-skilled needs generating opportunities for promotion and advancement at the workplace. However, technological change also brings about increasing levels of standardization and mass production, which permit a greater division of labor and the subdivision of multifaceted tasks into more narrowly defined assignments.

This simplification of tasks, or "deskilling", reduces the level of skill required by the worker to perform the tasks, and diminishes the worker's need for experience, decision making and judgement.[15] Empirical evidence indicates that tasks at all skill levels are subject to the deskilling process and to technology-induced skill obsolescence.

Deskilling need not, however, result in the downgrading or layoff of workers. Depending on the ways in which work assignments are allocated at the workplace, deskilling can result in the upgrading or promotion of workers who have been performing lesser-skilled functions. Employer hiring and staffing practices play a key role in how jobs and workers are affected by technological changes. Vocational education can and should assist, however, in minimizing the negative effects of technological change. Structural change and the likelihood of worker dislocation, more generally, suggest the need for a local skill retraining capacity even during prosperous periods. Moreover, times of rapid technological change intensify the need for programs enabling workers, at all occupational levels, to update their skills.

Training for Mature Businesses and Industries

The focus on new and emerging fields and industries is apparent in the Perkins legislation. The Act also addresses — although often indirectly — the needs of more traditional businesses and industries. Vocational programs are encouraged, for instance, that train workers "in skilled occupations needed to revitalize businesses and industries [Section 251(a)(4)]. More generally, as they seek to promote productivity and they experience technological change and new skill needs at the workplace, traditional employers can benefit from a wide range of programs encouraged by the Act.

While emerging industries are characterized by a relatively similar set of features, the organizational structure and employment needs of industries that have passed beyond the initial stage of development, vary widely.[16] Standardization and large volume, for instance, foster large firms to take advantage of economies of scale. As noted above, standardization in production also promotes the deskilling of tasks and the geographic dispersion of employment.

In many industries, however, a segment of production often remains in small batch jobs. For instance, firms that produce custom-designed goods, such as machine shops, metal fabricators and wood working shops, often are found in mature industries populated by small and medium sized firms.[17] An on-going supply of skilled workers is often critical to these employers to stay competitive. Yet smaller firms, with relatively limited human resource development capabilities and short internal job ladders, often are least able to provide training to meet their skill needs. Hence, smaller firms are likely to be much more dependent on external sources of skill training than are their larger counterparts. The needs of these firms are often overlooked in planning vocational education programs.

In summary, vocational education can facilitate economic development and structural change, as advocated by the Perkins Act, by adapting to the diverse and evolving skill needs of an area. To do so, however, vocational education policy must recognize and adjust to the dynamic nature of technological change and production processes. In particular, vocational education should be designed to evolve with production life cycles, recognizing innovations and developments in technologies, products and processes as signals to future

skill needs. Most importantly, the skill implications of these processes cannot be determined nationally — they must be monitored at the local level.

Moreover, the unpredictability of emerging skills, the importance of on-the-job training, and differences in skill and duration of training, mean that vocational education should be integrated with a wide range of educational and training institutions that provide job-related skills. The diversity of jobs and skill needs, futhermore, means that this comprehensive training approach must be linked to an equally broad-based local economic development strategy that recognizes the need for diversity of firms and industries in an area, and for flexible workers able to adapt to industrial and occupational employment shifts over time.

THE NEED FOR BALANCE IN TRAINING FOR ECONOMIC DEVELOPMENT

As they seek to meet the needs of changing labor markets, vocational educators must guard against being so "labor market responsive" as to undermine longer-term development of workers and of the local economy. A sensitivity to distinctions between short-run and long-run labor market conditions is essential in planning and evaluating vocational education programs. This is particularly important in light of evidence from case studies of economic revitalization that suggests that effective development strategies are likely to take years — possibly more than a decade — before "success" is achieved.[18]

The section addresses four specific topics — future skill surpluses, customized training, jobs in branch plants versus indigenous new firms, and serving new skills at the expense of the old —that highlight the importance of making these critical distinctions between short-term and long-term

economic development.

Generating Future Skill Surpluses

As vocational education becomes more attuned to meeting the new and emerging needs of employers, it does so at the risk of generating surpluses of trained workers in certain fields. Under the immediate pressure of unfilled jobs, it is tempting to implement quick and ambitious programs to expand the supply of trained workers, rather than relying on employers to solve some of their immediate staffing difficulties through changes in recruitment and internal training practices. Because the permanance of emerging skill needs are particularly hard to predict, moving quickly in response to employer pressure can lead to later skill mismatches.

For example, there are recent indications that many vocational educational institutions have jumped on the "high tech bandwagon" and may soon find themselves contributing to various skill surpluses in occupations such as computer programming and electronics technicians.[19] Ample evidence elsewhere suggests caution against rapid installment of programs to build up skill supplies unless the shortage is large and continued demand can be demonstrated.[20]

The Perkins Act advocates programs for meeting skilled labor shortages in high technology fields [Section 341(a)(1)]. Vocational education needs to be sensitive to balancing short-term considerations against longer-term skill prospects as it responds to this challenge. Vocational education planning and evaluation should address not only the existence of skill shortages but also such issues as how fast scarcities can be met and at what risk of eventually stimulating surpluses.

Customized Training

The Perkins Act promotes industry-education partnerships in curricular and program design, and, in some instances, programs "especially tailored to the needs of an industry or group of industries for skilled workers" [Section 322(b)(1)(C)(i)], and for "quick-start customized training for workers in new and expanding industries or for workers for placement in jobs that are difficult to fill because of a shortage of workers with the requisite skills" [Section 322(c)(ii)].

Many states and regions are seeking to attract employers and industries — particularly in high technology fields — by promising "tailor made" or custom-designed workforces to accomodate individual employer needs.[21] Programs tailored to provide employers with workers that meet their particular production needs, however, tend to reduce worker flexibility in the labor market. Vocational education should focus on providing skills that are transferable among different workplaces, guarding against providing training that is extremely narrow in scope or designed for any one employer's specific needs. Because young workers are likely to embark upon more than one career path in their worklife, programs for youth, particularly at the secondary level, need to be broad enough to enable them to work in a variety of situations and to adjust to structural change over the course of industrial development.

Some jobs require specific training that must be provided almost entirely on the job. For other occupations, however, such as medical technicians, clerical workers, and skilled crafts occupations, schools can provide most of the required skills. Vocational educators should identify these different patterns and concentrate on aspects of training in which they have a

competitive advantage. Vocational educators should work with businesses, unions, providers of government training programs, and other educators to determine the institutional mix that best meets the needs of the workers, as well as employers, in local economies.

Branch Plants versus Indigenous New Firms

The goal of promoting "the entry of new businesses and industries into a state or community" also suggests the need to differentiate between short-term and longer-term economic development strategies. Research indicates, for instance, that there are distinct differences between the contributions of branch plants of established firms and those of "home grown," new firms with respect to economic development of the area.[23] In particular, branch plants are likely to provide a larger number of jobs, at least in the short run, than the latter —and, hence, appear immediately successful. However, jobs at branch plants are more apt to involve relatively standardized production activities than are those at newly created firms indigenous to the area. Hence, jobs at branch plants generally are more vulnerable than "home grown" new firms, to dispersion to lower-cost areas outside of the area as product demand or competition intensifies. Moreover, given their mix of production activities and occupations, branch plants are less likely than indigenous new firms to act as a "seedbed" or "growth pole" in stimulating new spinoff firms and future employment opportunities in the area.[24]

Ownership arrangements of firms raise a further issue of local control — especially in light of recent trends toward greater globalization of industries and the increasing importance of multinational corporations in world trade.[25] Firms producing multiple products, in multiple locations are able to shift resources among product lines and plant sites. One can expect,

therefore, that local communities that are home to branch plants of established firms whose headquarters are located elsewhere, will exercise relatively limited control over employment and training activ' in the area. Corporate decisions that will directly affect the local community, such as those involving new product development, plant relocations, and hiring and staffing, are likely to be made elsewhere, with the overall goals of the parent corporation overriding local community needs.

A low-cost supply of labor may attract new branch plants or delay the exodus of local manufacturing jobs involving simplified production tasks. An economic development strategy designed to "capture" such jobs may provide a temporary respite from economic decline, however, may threaten longer- term growth and development in the area.

Serving the New -- at the Expense of the Old?

A key change in focus of the Perkins Act from prior vocational education legislation is the emphasis on allocating resources to new and expanding programs rather than to maintenance of existing programs. The Act also encourages programs "assist individuals to develop new skills to move away from declining occupational fields and enter new and emerging fields in high-technology areas and fields experiencing skill shortages" [Section 332(a)(4)].

The attraction of new and emerging businesses and industries can be, and has been, used effectively as an development tool in economically depressed areas.[26] However, as discussed above, "high technology" employment is not sufficiently large enough to "rescue" all such communities. Moreover, recent research suggests that many depressed communities may not have the wherewithall to attract venture capital funds and highly-skilled workers sought by high technology employers.[27]

Instead, the key to economic renewal for many communities may lie in a different type of "high tech" solution — the intregation of high technology products into more traditional industries to help them become more competitive.[28] More generally, research suggests that what "succeeds" in a community or region is a function of relative advantages, locally and nationally.[29] For employers in growing industries to be attracted to an area, it must offer a set of location advantages preferable to those available in other parts of the country.

The temptation to seek out new and emerging industries and businesses may drain resources from more traditional sources of employment. Even if new and emerging industries are successfully recruited, alternative employment can be "crowded out".[30] Labor shortages, particularly, in the blue collar and clerical fields attributable to the growth of new and emerging firms, for instance, tend to spill over into other sectors less able to compete for workers. By focusing on these spillover problems of skill replacement needs, vocational education can help prevent an economic development strategy from backfiring by impairing the competitiveness of established employers and prompting their "premature" departure from the area.

RESEARCH ISSUES REGARDING VOCATIONAL EDUCATION AND ECONOMIC DEVELOPMENT

In assessing the contribution of Perkins Act reforms to facilitating economic development, a wide range of questions need to be addressed. This section focuses on some of the major issues that require investigation.

I. THE RESPONSIVENESS OF VOCATIONAL EDUCATION TO CHANGING LABOR MARKET NEEDS.

1. Is vocational education responding to skill mismatches?

A quantitiative analysis of trends in occupational supply and demand should indicate potential skill shortages or surpluses and whether the vocational education system is moving in the same direction as the overall economy. Are training programs growing relatively fast in areas where job openings in related occupations have above average growth rates? Are programs growing relatively slowly or declining where related occupations are experiencing relatively slow growth or decline? Are programs available for occupations projected to grow relatively quickly? Which training programs have low rates of placement, and why?

2. How is vocational education monitoring current employment needs?

Occupational projections can best indicate employment needs in more traditional, relatively stable industries. Employment projections are much less likely to pinpoint potential training gaps in areas of new and emerging skill needs or in occupations experiencing sudden spurts in employment. Moreover, mismatches in skills supplied and demanded can occur when vocational education "responds" to past employment trends, that do not continue. When employment needs change in ways different from past trends, monitoring current employment trends is essential for determing labor market needs.

3. Is vocational educational responsive to "high technology"?

Training for "high technology" sectors requires a comprehensive program that addresses a wide range of industries, occupations, and skill requirements. Moreover, the industrial and occupational composition of "high technology" sectors differs considerably by geographic area. Vocational education programs to train for an area's "high technology" sector should be

designed to accomodate decline as well as growth, small firms as well as large, and a variety of industries and occupations that are likely to change over time.

4. How is vocational education helping to revitalize businesses and industries?

The bulk of employment and job openings in local economies are found in traditional industries and occupations. How is vocational education helping them improve productivity and remain competitive? Are the more traditional businesses and industries in the area being "crowded out" prematurely because vocational education programs are not meeting the skilled needs of these employers?

5. Is vocational education helping dislocated workers?

The vast majority of workers likely to be affected by technological change and industrial dislocation are already at work. The full spectrum of occupations are vulnerable to technology-induced deskilling and elimination. Moreover, industrial decline, employment cutbacks, plant closings and layoffs are inherent in the dynamics of production processes and industrial development. How well is vocational education preparing workers for upgrading and promotion opportunities brought about by technological change, and facilitating worker mobility, more generally, among places of work?

II. BALANCING SHORT-TERM AND LONGER-TERM DEVELOPMENT OBJECTIVES

1. Does vocational education recognize "training cycles"?

Vocational education cannot hope to prepare workers for the most advanced skill needs of companies that are at the forefront of technological change. However, as a technology develops and demands for new skills expand, skills

become more generalized and transferable among employers. Training can then be formalized and should be transferred to the educational institutions. Vocational education policies should recognize "training cycles" in order to facilitate this "natural" movement of skill training from the workplace to the formal education system. Because "training cycles" are derived from product and process cycles, however, their characteristics will vary by product, industry and firm, and among localities. The development of training programs that parallel "training cycles" requires close, on-going collaboration between employers and vocational educators at the local level.

2. Is vocational education guarding against future skill surpluses?

Identification of anticipated job openings is just the first step in determining training needs. Before translating job openings data into vocational education programs, alternative sources of labor supply should be considered. Might the unemployed, re-entrants to the labor market, or current employees fill those vacancies? What is the expected duration of skill shortages and the rates of pay for projected jobs? Are skill scarcities likely to attract workers from other areas? By themselves, statistics on employment demand, even when compared with data on the supply of training program completions, may be misleading and suggest erroneous policy implications. Labor shortages may, for instance, be the result of high turnover induced by low pay or otherwise poor working conditions. Alternatively, job openings may occur in occupations that are generally filled from within the firm — creating actual job openings at entry-level jobs at other skill levels.

3. Is vocational education providing transferable skills?

The evolving nature of technological change and economic development emphasizes the need for workers able to adapt to industrial and occupational shifts over time. The time frame in which planning and evaluation decisions are made, often differ for educators and employers, with the latter generally being much shorter than the former. Vocational education programs, including customized training, should provided skills that are transferable among a variety of workplaces, guarding against providing training that is extremely narrow in scope or designed to meet the needs of one employer's "specific" needs. Much better information on the actual transferability of skills among industries and occupations within local labor markets is needed than has been available in the past. This can be determined by identifying the various occupational and skill needs of businesses and industries in the area, and by looking at local patterns of job changing.

4. Is vocational education fostering a diverse employment base?

The vulnerability of a particular community or region to the destabilizing effects of production life cycles depends on the area's mix of businesses and industries. A diversified employment base provides alternative job opportunities for dislocated workers. In contrast, an area whose employment is linked to one major employer or several firms providing products in similar stages of production, is susceptible to a prolonged period of economic stagnation should its jobs be relocated or eliminated. The combination of production life cycles and the potential "crowding out" effects of a successful firm or industry, suggests the need to cultivate a diversity of firms and industries in an area even during prosperous times if economic growth and development are to continue in the long run.

III. VOCATIONAL EDUCATION AND THE EDUCATION AND TRAINING NETWORK

1. Is vocational education helping to foster the institutional and program mix best-suited to promote economic development?

The various institutional components of the education and training network emphasize different goals, face diverse constraints, and play disparate roles in preparing individuals for employment. Such diversity generates a range of institutional patterns and responsibilities and a mix of business-education linkages within local labor markets. Vocational education cannot and should not be expected to train for every skill need. Moreover, the reality of limited resources in vocational education focuses attention on the need to establish priorities, recognizing that tradeoffs are inevitable. Vocational education should, however, be an integral part of a local education and training system that fosters competitive advantage of its components — including, for example, apprenticeship programs, employer training, the military, programs supported by JTPA — that best meets the needs of workers and employers in the area.

HOW TO ASSESS VOCATIONAL EDUCATION AS A TOOL FOR ECONOMIC DEVELOPMENT

The issues and questions discussed above suggest the need for an approach to the assessment of vocational education as a tool for economic development that is disaggregated to the level of decision makers in local labor markets. There is a need to focus on firms, products, and local labor markets to better understand the relationships between vocational education and economic development, and to identify factors leading to divergent

outcomes. Industry studies and national statistical studies cannot address the types of analytical concerns posed by this report.

The use of detailed case studies of local labor markets for such assessments is further supported by empirical evidence that demonstrates:

(i) regional specialization within industries by type of production activity, such as R & D, or the assembly of relatively standardized products,

(ii) regional specialization of production activities within multi-national, multi-product, and multi-plant firms;

(iii) considerable diversity among local areas in their resource mixes, relative factor costs, and market demands;

(iv) widespread diversity among local high technology sectors;

(v) variation in successful economic development strategies among local economies; and

(vi) considerable variation among local education and training networks.

Research Approach

When analyzed through various classification schemes, such as by type of employment sector (high technology or traditional), degree of employment diversification, and the like, and when viewed in light of the theoretical framework of production life cycles, an extensive, detailed account of how vocational education relates to economic development can be derived from the case studies.

The case studies could focus, for instance, on a variety of local areas representative of particular "types" of labor markets. These might include case studies of:

(i) labor markets populated by "high technology" employment — distinguishing between areas in which the "high technology" sectors are comprised primarily of branch plants of firms based elsewhere, and those composed mainly of "home grown" indigenous, new firms;

(ii) economically depressed labor markets — distinguishing between areas in which the traditional sector involves primarily low-wage, low-skill production jobs, such as those in apparel, textiles or shoes, and those composed of relatively high-wage, highly-skilled jobs, such as those in automobiles and steel;

(iii) labor markets with highly diversified employment bases with respect to product and industrial mix, in contrast to labor markets dominated by one employer or group of employers producing products at similar stages of production;

(iv) labor markets in which the bulk of employment is in smaller firms producing custom-designed, or specialty products, compared to labor markets in which large-scale, relatively standardized production dominates;

(v) rural and agricultural labor markets compared to urban labor markets.

This research approach should help to identify common trends and patterns as vocational education seeks to facilitate economic development In addition, it should pinpoint vocational education examples "that work" and those "that don't work" under particular circumstances, and identify factors responsible for divergent outcomes.

Procedures

Two complementary research procedures are suggested by this approach. First, the collection and analysis of historical, economic, business, and educational data, to derive a quantitative overview of trends in the local employment base, and the education and training network. Second, intensive micro-studies of contemporary business practices, and of decision making and change within education and training institutions, derived from interviews with employers, educators and other providers of job-related skills.

The first procedure needs to draw upon a wide variety of data sources, such as the U.S. Census of the Population, the Census of Manufacturing, County Business Patterns, Employment Security data, area wage surveys, data on plant expansions and closings, MOICC data, unpublished Ph.D dissertations, industry-specific books and trade journals, company annual reports. government studies, data on trained graduates, placement and follow-up of graduates. The field research will help to explore and better understand less readily quantifiable factors that may have important impacts on economic development.

The two procedures reinforce one another. The historical and statistical analyses help to verify and generalize the findings of the micro case studies; the micro-studies help to interprete the quantitative findings. Only in this way can vocational education be linked more directly to industrial and technological change, and to changes in the organization of work and the strategies of businesses, that underlie economic development. By pinpointing where and how vocational education can effectively foster economic development, this research approach should also highlight areas for future change in federal vocational education legislation.

FOOTNOTES

1. See for example, Abernathy, Clark and Kantrow, 1983; Bluestone and Harrison, 1982; Hekman, 1980a, 1980b; Mensch, 1979.

2. Kuznets, 1930; Burns, 1934; Alderfer and Michl, 1957.

3. Levitt, 1965; Vernon, 1966, 1970; Hirsch, 1967, 1972; Wasson, 1978; Norton and Rees, 1979; Utterback and Abernathy, 1975; Hayes and Wheelwright, 1979a, 1979b; Ford and Ryan, 1981.

4. Abernathy, 1978; Abernathy and Utterback, 1981; Abernathy, Clark and Kantrow, 1983; Hekman, 1980a, 1980b; Hirsch, 1967; Alderfer and Michl, 1957; Hoover, 1948.

5. Norton and Rees, 1979; Tilton, 1971; Wells, 1972; Stobaugh, 1972; Vernon, 1970; Houthakker and Magee, 1969.

6. Flynn, 1986.

7. For a detailed analysis of specific versus general skills, see Becker, 1964.

8. Markusen, 1985; Malecki, 1983, 1986(forthcoming); Thwaites and Oakey, 1985; Office of Technology Assessment, 1984; Norton and Rees, 1979.

9. See, for example, Office of Technology Assessment, 1986, particularly Chapter 8 "The Effects of Technological Change in the Nature and Availability of Jobs," Attewell and Rule, 1984; Adler, 1983; Flynn, 1985, 1987(forthcoming).

10. For a review of state initiatives to attract high technology employers see, Office of Technology Assessment, 1983.

11. Vinson and Harrington, 1979; Munzer and Doody, 1981; Browne, 1983; Karmin, 1984; Riche, Hecker and Burgan, 1983.

12. Porter, 1980.

13. Doeringer and Flynn, 1982; Browne, 1983; Levin and Rumberger, 1983; Flynn, 1984; Karmin, 1984; Attewell and Rule, 1984; Rees, 1986..

14. See, for example, Taylor, Coppin and Wealthy, 1985; Rada, 1980; Forester, 1983; Peitchinis, 1983; Green, Coombs, and Holroyd, 1980.

15. Bright, 1958; Kraft, 1977; Greenbaum, 1979; Braverman, 1974; Flynn, 1985.

16. Porter, 1980; Chandler, 1977; Alderfer and Michl, 1957.

17. For a detailed study of economic development in a local labor market comprised of a wide range of small firms in relatively mature manufacturing industries, see Doeringer, Terkla and Topakian, 1986.

18. Segal Quince Wickstead, 1985; Flynn, 1984b; Oakey, 1984.

19. Grubb, 1984.

20. Freeman, 1971; Freeman and Hansen, 1983; Fogel and Mitchell, 1974; Doeringer, Flynn and Tandon, 1981.

21. Office of Technology Assessment, 1983, plus a wide range of newspaper articles.

22. Vermeulen and Doeringer, 1981; Osterman, 1984; Doeringer and Piore, 1970.

23. Krumme and Hayter, 1975; Thomas, 1980; Harris, 1986 (forthcoming); ; Bergman and Goldstein, 1986 (forthcoming); Malecki, 1986 (forthcoming).

24. Rees and Stafford, 1984; Thomas, 1975, 1985; Malecki, 1983.

25. Vernon, 1979; Harris, 1986 (forthcoming); Porter, 1980.

26. Flynn, 1984b.

27. Oakey, 1984.

28. Browne, 1983.

29. Flynn, 1984b.

30. See, for example,Flynn, 1984.

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