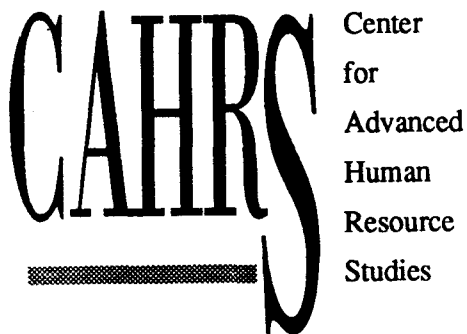


EMPLOYER  
TRAINING & SKILL  
SHORTAGES:  
A REVIEW OF THE  
STATE OF  
KNOWLEDGE

Working Paper 91-32

John Bishop





**EMPLOYER TRAINING and SKILL SHORTAGES:  
A REVIEW OF THE STATE OF KNOWLEDGE  
with  
RECOMMENDATIONS FOR FUTURE RESEARCH by the DEPARTMENT OF LABOR**

If the Germans had any secret weapon in the post-1973 economic difficulties, it is the technical competence of their work force, which is in turn the product of their apprenticeship system. --Limprecht and Hayes, 1982, p.139.

I think that the Japanese education system is not very good....employer training is much more effective. --Yutaka Kosai, President, Japan Center for Economic Research, 1989

The heart of this new [flexible] manufacturing landscape is the management of manufacturing projects: selecting them, creating teams to work on them, and managing workers' intellectual development. --Ramchandran Jaikumar, 1986, p. 75.

A growing number of commentators are pointing to employer sponsored training (OJT) as a critical determinant of competitiveness and standards of living. American employers and workers, it is charged, are failing to invest sufficient time and resources in training on the job (Commission of the Skills of the American Workforce 1990). The Office of Technology Assessment (1990), for example, concluded:

When measured by international standards, most American workers are *not* well trained. Many in smaller firms receive no formal training. Larger firms provide more formal training, but most of it is for professionals, technicians, managers, and executives. Our major foreign competitors place much greater emphasis on developing workforce skills at *all* levels....Our major trading competitors provide more and better worker training (p. 3,4).

Training is an extremely important issue, but very hard to study. Government statistical agencies have only recently begun asking questions about it and there is, at present, no standardization of data collection procedures across countries. Most training is informal in character and therefore hard to measure. Its effects on productivity are also difficult to quantify. Consequently, there have been almost no studies of the central issue of the impact of employer training on worker productivity. Research has, consequently, focused on issues such as who gets formal training and the impact of formal training (or tenure interpreted as a proxy for informal training) on tangential outcomes such as wage rates and turnover. The findings of this research are reviewed in sections 1.1 and 1.3.

An elegant theory has been developed that attempts to explain how the quantity of training is determined and who pays for and benefits from it. However, the absence of data on the key theoretical constructs of the theory--general training, specific training, informal training and productivity growth--means that the only predictions of the theory that have been tested relate to the effects of formal training and tenure on wage growth and turnover. Definitive tests of the OJT theory have not been forthcoming because the large number of unobservables means that any given phenomena has many alternative explanations (Garen, 1987).

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Working Paper # 91-32

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Consequently, a good deal is known about the incidence of formal training and about the effect of tenure and formal training on wages and turnover, but little is known about its impact on productivity. Employers arrange for and pay for training because it raises productivity; not because it raises wages. Policy maker's interest in training derives from its effect on productivity; not its effect on wages. The two effects are generally not the same. Highest priority should be given to research on the productivity effects of training. Studies of wage effects alone have lesser priority.

This report proposes that the Department of Labor undertake a program of research designed to inform the policy debate related to skill shortages and the role of employer training in ameliorating them. The paper reviews the currently available evidence and then proposes new research on seven questions.

1. **HOW DO TRAINING AND SKILL DIFFERENTIALS ACROSS COUNTRIES AND ACROSS FIRMS WITHIN A COUNTRY EFFECT THE PRODUCTION PROCESS AND FIRM PRODUCTIVITY? HOW DO SKILL DIFFERENTIALS INFLUENCE THE IMPLEMENTATION OF FLEXIBLE DECENTRALIZATION, TOTAL QUALITY MANAGEMENT AND OTHER EFFORTS TO ACHIEVE A HIGH PERFORMANCE WORK ORGANIZATION?**
2. **HOW IS THE AMOUNT AND CHARACTER OF THE EMPLOYER TRAINING CHANGING OVER TIME?**
3. **DO AMERICANS RECEIVE LESS TRAINING FROM EMPLOYERS THAN THEIR COUNTERPARTS OVERSEAS?**
4. **ARE THEY LESS SKILLED?**

Assuming an affirmative answer to the third and fourth questions:

5. **WHY ARE AMERICAN WORKERS LESS WELL TRAINED AND LESS SKILLED?**
6. **IS THERE MARKET FAILURE IN THE PROVISION OF EMPLOYER TRAINING?**
7. **IS SCHOOL PROVIDED OCCUPATIONAL TRAINING A SUBSTITUTE OR A COMPLEMENT FOR TRAINING ON THE JOB?**

Most of these questions cannot be answered in currently available data sets. I, therefore, propose that the Department of Labor concentrate on funding studies which collect and analyze new data. The most important issue for research is # 1, the effect of training on production processes and productivity. Studies that look at training without evaluating its outcomes should receive lower priority.

For most kinds of training, outcomes are as much organizational as individual. Consequently, a good deal of effort needs to be devoted to studies conducted at the organizational level which examine how training fits into the organization's overall competitive strategy and effects its profitability. Examples of the kinds of studies that need to be replicated are the work of John Krafcik (1990) and John Paul MacDuffie on auto assembly plants around the world, the study of computerized machine tools by Hartman and colleagues (1983), Ramchandran Jaikumar's (1986) study of flexible manufacturing in Japan and the United States, Maurice and Sellier and Silvestre's (1986) comparison of French, German and British plants and the intensive case studies of specific industries conducted by S. J. Prais, Hillary Steedman, Karin Wagner and collaborators at the National Institute of Economic and Social Research in London.

The paper is organized as follows. The first section of the paper presents a quick review of what is known about Questions # 1 to 4. Some unique data on the magnitude and effects of the new hire training and how it varies by occupation are presented in section 1.1. Estimates of training's impact on productivity growth of new hires are presented in section 1.2. Other research on the incidence and effects of formal training is reviewed in section 1.3. In section 1.4 the limitations of currently available data on training and its effects are discussed and new data collection is recommended. In section 1.5 I propose a new approach to asking questions about on-the-job learning and training.

Section 2 of the paper presents a preliminary examination of Question # 5--why American employers and workers appear to invest less in training than the Germans and Japanese. Section 3 presents a preliminary examination of Question # 6. It examines what is known about the extent of market failure in the provision of employer training. Studies of apprenticeship programs in Germany, Great Britain and the United States suggest that employers are financing part of the cost of apprenticeship training. Econometric analysis of wage levels and rates of wage and productivity growth due to tenure also suggest that employers are contributing to the costs of non-apprenticeship training that develops skills which are useful at many firms. If this is indeed the case, the training market is probably generating less training than would be socially optimal. More research is required on this topic. Section 4 examines the advantages and disadvantages of locating occupational training in enterprises rather than schools. *Priorities for future research are discussed at many different places in the text, generally immediately following a discussion of the past research which informs and guides my proposals. These sections are highlighted by appearing in **large print bold italics**.* The final section of the paper recapitulates the recommendations for new research.

## I. WHAT IS KNOWN ABOUT THE INCIDENCE AND IMPACTS OF TRAINING?

### 1.1 Estimates of the Magnitude of On-the-Job Training of New Hires

Let us begin by examining the magnitude of training investments in newly hired workers. The data which form the basis of discussion come from a survey of 3,412 employers sponsored by the National Institute on Education and the National Center for Research in Vocational Education (NCRVE) conducted between February and June 1982. Most of the respondents were the owner/manager of small firms who were quite familiar with the performance of each of the firm's employees. Seventy percent of the establishments had fewer than 50 employees, and only 12 percent had more than 200 employees.

### How Training Varies with Occupation

The impact of occupation on the amount of on-the-job training typically received by a new employee is examined in table 1. The first four rows of the table describe the average number of hours devoted to four distinct training activities during the first 3 months after being hired. Even jobs that are thought to require little skill--service jobs--seem to involve a considerable amount of training during the first 3 months: an average of 33 hours of watching others, 5.7 hours of formal training, 35 hours of informal training by management and 17 hours of training by coworkers. Other occupations devote considerably more time to training. The distribution of training activities is similar across occupations, however. The typical trainee spends most of his training time watching others do the job or being shown the job by a supervisor. Roughly equal amounts of time are spent in each. Informal training by coworkers is next most important. Formal training provided by specialized training personnel accounts for an average of only 5 to 10 percent of the time new hires are engaged in a training activities.

These estimates of the incidence and extent of skill upgrading training are much higher than those generated by surveys of corporate training directors and workers. Training directors are able to describe the formal training programs offered by their company but are typically not aware of the full extent of the informal training that occurs on the shop floor. Surveys of workers about their training experiences have been handicapped by the way questions were posed. The January 1983 CPS, for example, asked "Since you obtained your present job, did you take training to improve your skills." The problem with this question is that one does not take informal training. Most informal training occurs in the context of normal supervision or in response to a worker's request for an explanation or assistance from a coworker or supervisor. As one might anticipate, this question results in a significant under estimate of the extent of informal training; only a third of the respondents reported they had received any skill upgrading training and only about 40 percent of the skill training "taken" was reported to be informal. *This suggests that the CPS survey and similar questions in the NLS and High School and Beyond fail to pick up much of the informal OJT that workers receive. Consequently, studies using these data are looking at only one species of tree not the whole forest. If we are to really understand how learning on the job occurs both for individuals and for organizations, it will be necessary to change the way we ask questions about training in the CPS and other surveys.*

*It also implies that international comparisons of training cannot focus on the training that is managed by corporate training departments. Training departments are typically larger in big American corporations than in Japanese corporations. In Japan corporate budgets for formal training are quite small-- 0.5 percent of the wage bill in firms with more than 5000 employees and 0.1 percent in firms with 30-99 employees (Dore and Sato 1989). The massive*

**TABLE I**  
**TRAINING AND PRODUCTIVITY GROWTH OF TYPICAL NEW EMPLOYEES**  
**BY**  
**OCCUPATION**

	Profes- sional	Mana- geral	Sales Not Retail	Retail Sales	Clerical	Blue Collar	Service
<u>Hours Spent in Training in First 3 Months</u>							
Watching others do the job	60.0	65.0	82.8	39.2	50.4	48.1	32.7
Formal training programs	9.1	12.1	23.9	8.2	13.5	9.1	5.7
Informal training by management	76.6	80.4	71.8	48.5	54.6	49.3	35.1
Informal training by co-workers	31.8	23.0	33.9	23.9	26.2	26.8	16.7
<u>Investment in Training Time</u>	293	295	350	185	235	200	130
Weeks to become fully trained if no previous experience	11.1	13.4	9.2	6.5	6.7	9.0	3.4
<u>Increase in Reported Productivity (%)</u>							
Betw. first 2 wks. & next 10 wks.	28%	32%	50%	30%	40%	32%	28%
Betw. first 3 mo. & end of year 2	38%	33%	56%	25%	32%	23%	17%
<u>Increase in Real Wage in First 2 Yrs. (%)</u>	5.0%	7.7%	22.6%	9.7%	11.5%	11.5%	3.7%
Number of cases	95	112	76	203	429	649	334

NOTE: Sample is limited to jobs for which all the necessary questions on wage rates, training time, and productivity were answered.



*investments that Japanese firms make in cross training and employee rotation do not appear in these budgets.*

The fifth row of the table merges the information on time devoted to particular types of training into a single overall estimate of investment in training during the first 3 months on the job. The index values the time that managers, coworkers and the trainee devote to training and express it in terms of hours of trainee time. Training investment for service jobs is estimated to be 130 hours implying that the time invested in training a typical newly hired service worker in the first 3 months is equal in value to about 25 percent (130/520) of that worker's potential productivity during that period. Investments in training are considerably greater in other occupations. Retail (and service sector) sales and blue collar jobs have a mean index of 185 to 200 hours respectively or 35 to 38 percent of the new employee's potential productivity. Clerical jobs typically required the equivalent of about 235 hours of training or about 45 percent of the new worker's potential output. Professional, managerial and sales representatives outside the retail and service sectors required the equivalent of about 300 hours of on-the-job training or nearly 60 percent of the new worker's potential output.

The sixth row of the table reports the geometric mean of the answers to the question "How many weeks does it take for a new employee hired for this position to become fully trained and qualified if he or she has no previous experience in this job, but has the necessary school-provided training." Service jobs are reported to require an average of only 3 to 4 weeks of training, retail sales and clerical jobs slightly under 7 weeks, and professional and managerial over 10 weeks.<sup>1</sup>

The reported productivity of new employees increases quite rapidly (by roughly a third) during the first month or so at the firm (see row 7). Despite the much greater time interval, the percentage increases between the first quarter and the end of the second year (see row 8) are smaller than those during the earlier period for blue collar, service, clerical and sales jobs. For these occupations training investments and learning by doing seem to be large in the first few months on the job but to diminish rapidly thereafter. In the higher level, managerial and professional jobs, reported increases in productivity are larger between the third and 24th month than in the first few months. This reflects the more prolonged training period for these occupations. The occupations which devote the least time to training--the service occupations--are the occupations with the smallest increase in productivity with tenure. The reported productivity of service workers improves an average of 28 percent in the first month or so and a further 17 percent in the next 21 months. Occupations for which a lot of time is devoted to training in the first 3 months--professionals, clerical workers, managers and sales representatives outside of retail and service industries--also seem to have larger than average increases in reported productivity as the worker gains in tenure. Clerical workers, for instance, are reported to be improving their productivity by 40 percent in the first month or so and by a further 32 percent by the end of the second year on the job.

These very rapid rates of productivity growth suggest that the total rates of return (combining both worker and employer benefits and costs) may be extremely high during the first months of employment. For clerical workers the total costs of training during the first 3 months are 235 hours or .113 of a year's output by a worker whose skill level is equal to that of a new employee. Since this figure is an upper bound on the investment that contributed to the 40 percent gain during the first months on the job, the average rate of return must be above 354% per year ( $.40/.113$ ). Since the intensity of training investment falls with tenure at the firm, the cost of training investment during the next 21 months cannot have exceeded .7875 ( $1.75*235/520$ ) of a year's productivity by a newly hired worker. This implies that the average rate of return to training investments during this 21 month period exceeds 40% per year ( $.32/.7875$ ). However, marginal rates of return to training investment are lower and some of the gain in productivity results from learning by doing and not from training. Multivariate cross section models of productivity growth which yield evidence on the marginal productivity of training are presented below.

## 1.2 The Payoff to New Hire Training

The analysis of EOPP data presented in Bishop (1990) and Appendix A generated tentative estimates of both the opportunity costs and the productivity effects of training (general and specific, worker and firm financed combined). It would appear, therefore, feasible to calculate marginal gross rates of return (for general and specific training combined) necessary to cover the cost of capital, losses due to turnover and obsolescence. The data were not collected for this purpose, however, so there were gaps that could only be filled by some judicious assumptions.<sup>2</sup> Consequently, the estimates of marginal gross rates of return for each form of training that are reported in Table 2 must be viewed as very tentative results which will hopefully be displaced when better data sets become available. Marginal GRORs are the ratio of the increment to yearly productivity generated by a small increase in training divided by the cost of increased training (A detailed description is in the notes of the table).

The estimated marginal gross rates of return diminish as the intensity of training increases. The mean training intensity for the first 3 months expressed in units of the time of trained workers is 148 hours. As intensity during the first 3 months rises from 100 hours to 300 hours (double the mean), the marginal gross rate of return (GROR) for informal OJT by co-workers drops from 43-45 percent to 25-32 percent in the two linear models for typical new hires presented in Appendix Table 1. The linear model's GROR drops from 38-43 percent to 25 percent for watching others and from 17-23 percent to -1 to 10 percent for training by supervisors. The marginal GROR of formal OJT is estimated to drop from 11-15 percent at 100 hours to -3 percent at 300 hours. Estimated gross rates of return calculated from models based on logarithmic specifications are considerably higher than those based on linear specifications of productivity growth. Gross rates of return are also typically higher for the models using the logarithm of training intensity and the square of this logarithm

Table 2  
Sensitivity of Marginal Gross Rates of Return Estimates to Specification

	Formal Training		Training by Supervisors		Training by Co-Workers		Watching Others	
	100 hrs	300 hrs	100 hrs	300 hrs	100 hrs	300 hrs	100 hrs	300 hrs
Typical Individual								
Linear	11%	- 3%	23%	10%	45%	32%	38%	25%
Logarithmic	38%	15%	46%	24%	85%	63%	113%	90%
Particular Individual								
Linear	15%	- 3%	17%	- 1%	43%	25%	43%	25%

Table 3 of (Bishop 91)

Typical Individual								
Logarithmic	118%	54%	99%	48%	112%	53%	128%	58%
Linear	43%	16%	41%	16%	48%	18%	50%	18%
Particular Individual								
Logarithmic	156%	68%	109%	52%	130%	59%	146%	64%
Linear	46%	16%	38%	13%	47%	16%	46%	16%

Estimates of the marginal gross rates of return to increases in the intensity of training at two different levels of training intensity: a 100 hour investment during the first quarter of the job and a 300 hour investment during the first quarter on the job. Hourly cost factors are assumed to be 1.8 for formal training, 1.5 for training by supervisors, 1.0 for training by coworkers, and 0.8 for watching others. When productivity growth over 2 years for the typical individual is being modeled, duration adjusted cost factor is calculated by multiplying by the hourly cost factor by 3 for the reasons given in the text. When productivity growth of a particular individual during the first 14 months is modeled, the duration adjusted cost factor is calculated by multiplying the hourly cost factor by 2.2. The results presented in the first panel are calculated by taking the derivative of the estimated regression equations reported in tables A1 with respect to hours of the specified kind of training, then multiplying by 2000, the assumed number of hours worked in a year, and then dividing by the duration adjusted cost factor. As an example of the calculation, the formula for formal OJT using the coefficients from the linear model in table A1 for training intensity (T) equal to 300 hours was as follows:

$[(.00046 - .00000049 * T^2 * 1.8) * 2000] / [3 * 1.8] = -.0256$  and the coworker training formula is:

$[(.00077 - .00000049 * T^2) * 2000] / [3] = .3173$ . {Note that the coefficients must be divided by 100 and 10000 in order to scale them in hours of training}. The GROR estimates presented in the second panel assume that the firm has 18.5 employees (this zeros out the 5th and 7th terms of equation 3) and that all of the training received is of the type indicated. For informal training by supervisors, the formula is:

$(b_2 + b_3 * \ln T^2) * 2000 / (T * \text{duration factor})$  which is  $[(.003 + .0064 * 4.605^2) * 2000] / (100 * 3) = .4176$  at T=100 for the linear productivity growth model for typical workers. For training by watching others, the formula is  $(b_2 + b_{5F} + b_3 * \ln T^2) * 2000 / (T * \text{duration factor})$  which is  $[(.003 + .013 * S_w + .0064 * 4.605^2) * 2000] / (100 * 3) = .504$ .

Obsolescence of skills and turnover mean that these cash flows do not have an infinite duration and should therefore be compared to the sum of the interest rate, the obsolescence rate and the turnover rate times the proportion of skills that are effectively specific to the firm.

presented in Appendix Table 2. At the training intensities that typically prevail during the first quarter, marginal gross rates of return are often above 40 percent.

It must be remembered, however, that these marginal GRORs include cash flows necessary to compensate for turnover and obsolescence and are, therefore, not directly comparable to the real rates of return to schooling and financial assets that typically lie in the range from 5 to 10 percent. If all training investments are specific to the firm and must, therefore, be written off if workers leave and rates of turnover are high, first year GRORs of 30 percent or more will be required to induce the firm to invest in specific training. Lillard and Tan (1986) have estimated that the wage effects of formal training depreciate (either due to obsolescence or changing jobs) at 15 to 20 percent per year. This also would imply that equilibrium in the training market would likely yield marginal GRORs of 30 percent or more. Tan et. al. (1991), however, estimates a much lower depreciation rate for wage rate effects of company training--6 to 7 percent per year. With all the uncertainties regarding the best specification of the productivity growth model, measurement error in the training variables, the specificity of the training, turnover rates, and the obsolescence rates, it is my view that robust estimates of net rates of return to general on-the-job training comparable to rates of return on financial assets and physical capital are not now feasible and will not be feasible until better data sets become available.

### 1.3 Summary of Empirical Findings

The major findings derived from Bishop's analysis of employer data on new hire training presented in the first part of the paper may be summarized as follows:

- \* Formal training provided by specialized training personnel accounts for only a small portion of the training received by new hires.
- \* When informal training is included in the total, training investments in new hires are substantial even for jobs that are generally considered unskilled.
- \* Productivity rises substantially during the first year on the job.
- \* Large establishments invest more in the training of their new hires than small and medium sized establishments apparently because (1) they have lower turnover, (2) they have better access to capital markets, (3) the marginal product of an hour of training time is higher at large establishments and (4) training lowers turnover more substantially at large establishments.
- \* Informal training by coworkers and training by watching others do the job appear to have a higher benefit cost ratio than informal training by management.
- \* Estimates of rates of return to training derived from this data should be treated with a great deal of caution. Nevertheless, marginal rates of return to training appear to be quite high.
- \* The estimated benefit cost ratio for formal training depends on how the model is specified. The productivity growth effects of formal training are bigger at large establishments. Formal

training has significantly larger effects on wage growth than informal training. Formal training's tendency to have larger effects on wage growth and quit rates than informal training probably results from the fact that formal training is better signaled to the labor market.

- \* The reported generality of training has no significant effects on its marginal productivity.
- \* When training is reported to be highly general, training has a larger effect on wage growth than when training is reported to be specific. Nevertheless, training that is reported to be entirely general has much larger effects on productivity growth than wage growth implying that the labor market treats this training as if it were at least partly specific to the firm.

Studies using individual data typically tackle different issues. Lisa Lynch's recent review of the literature on the incidence and impact of formal employer sponsored training concluded that:

- \* Formal on-the-job training significantly raises wages for workers
- \* Formal off-the-job training improves earnings but not as much as on-the-job training
- \* While there is not a significant difference in the probability of males and females receiving any type of training, males are more likely to receive OJT and females off-the-job training
- \* Nonwhites are less likely to receive on-the-job training than whites, holding all other characteristics constant
- \* The likelihood of receiving company provided training drops when the local labor market has high unemployment
- \* Company provided training for young workers is not very general, i.e. not portable from employer to employer
- \* While there is a link between schooling and company training it is not so much in the number of years of school but rather in whether or not the individual has finished high school or college
- \* Rapid technological change in the industry of employment increases the probability of receiving managerial training and in-house company programs
- \* Being in a union significantly raises the probability of receiving on-the-job training or being an apprentice
- \* Managers, professional and technical employees are most likely to receive company training. (Lynch, 1991, p. 124)

One of the most serious problems with research on training is the lack of careful analysis of the quality of the available data on training. This gap has recently been remedied in part by Zemsky and Shapiro's (1991) comparison of training incidence in different surveys. Comparing CPS and SIPP answers to almost identical questions about formal training necessary to get and keep one's job, they found large discrepancies between the number of people reporting that they received such training in the two surveys. It would appear that answers to questions about formal training are quite sensitive to context--nuances in the wording of questions, the format

and length of the interview, where the question is placed in the interview and which the questions appear immediately before the training question. *This finding implies that the effort to obtain reliable measures of training by asking only about the most salient form of training--formal training--has failed. Clearly the word "training" means different things to different people and the interpretation of the word depends upon context. That is why future data collection regarding this issue should ask about "learning how to do one's job better" and not about training.*

#### 1.4 What Do We Need to Know about How Employer Training Differs Across Nations ?

American employers appear to devote less time and resources to the training of entry level blue collar, clerical and service employees than employers in Germany and Japan (Limprecht and Hayes 1982, Mincer and Higuchi 1988, Koike 1984, Noll et al 1984, Wiederhold-Fritz 1985). In the automobile industry , for example, newly hired assembly workers receive 310 hours of training in Japan and 280 hours of training in Japanese managed plants located in the US, but only 48 hours of training at US owned plants in the US (Krafcik 1990). Averaged over all auto assembly workers, annual training time is nearly three times greater in plants located in Japan and about 80 percent greater at Japanese plants located in the US. These differentials in training are one of the reasons why Japanese plants are more productive than American plants and Japanese built cars have such a reputation for quality. German employers train their youthful apprentices much more thoroughly than American employers train their teenage workers. One visible manifestation of this is the sales personnel one deals with in Germany. They are generally much more knowledgeable about the products they are selling than American sales clerks.

Most of what we know about comparative levels of skill and training investment comes from just a few case studies and a host of anecdotes. Clearly there is a need for systematic data collection. This need has also been perceived by the National Educational Goals Panel. The Technical Panel responsible for preparing methods of monitoring progress toward the goal of a literate workforce proposed the following:

*The Technical Panel recommends that any cross-national comparison include the cross-occupational skills required in the workplace: the foundation skills and SCANS skills. Worker performances involve four types of skills and knowledge:*

- o the foundation skills, knowledge, and orientations (these include the basic skills of reading, writing, mathematics, listening, and speaking; the higher order cognitive skills, such as metacognitive skills and learning strategies; and attitudes or orientations, such as taking responsibility);
- o the SCANS generic functional skills, which appear in many different occupations and industries;
- o occupationally-specific knowledge and skills; and
- o company-specific knowledge and skills.

The panel felt that K-12 should have responsibility for developing the foundation and SCANS skills. These skills therefore properly fall within the purview of the National Goals Panel. The educative responsibility for occupationally-specific skills is shared between K-12, post-secondary schools, and employers, but the very specificity of these skills make them unlikely candidates for a cross-national assessment. Company-specific skills are proprietary, entirely the training responsibility of employers, and therefore outside the scope of the National Goals Panel.

*A cross-national assessment of the foundation and SCANS skills requires a measurement battery that extends substantially beyond even a "strengthened" NALS....*

*To develop an adequate cross-national assessment of cross-occupational workplace skills, the Technical Panel recommends a staged development process....*

*The Technical Panel recommends that even the R&D for the cross-national assessment be done cross-nationally, preferably through a cross-national R&D team drawn from research institutes in the different countries....*

*The Technical Panel recommends that the levels of each of the skills measured in the cross-national assessment be benchmarked against the levels required for expert performance in broadly different occupational categories....*

*The Technical Panel recommends obtaining a descriptive distribution by country of those workplace characteristics that affect skill and skill level requirements....*

*The details of sampling and data collection strategies should be left to the R&D teams....*

This data collection program is desirable but the cost and complexity of the project insures that it will be many years before data of this type becomes available. A more serious objection to this proposal is its lack of attention to occupational and firm specific skills. In my judgement, occupational and firm specific skills are many times more important than generic skills in accounting for productivity differences between individuals and enterprises.<sup>3</sup> Basic and generic skills are useful not so much because they directly contribute to productivity but because they help workers learn the occupational and firm specific skills that determine productivity. A further difficulty of this approach is the constraints on data collection that result from attempting to study representative samples of workers. This makes meaningful measurement of occupation specific skills and the productivity outcomes of training just about impossible.

*If employer training rather than schooling outcomes is to be the focus, a very different data collection strategy is implied. Case studies are needed which focus on a specific sub-industry or a specific production process. Only by narrowing the focus in this way is it possible to get good measures of the context, character, cost, and consequences of training. Hard data is essential, so data collection strategies must be adapted to the technology and skill development institutions of the subindustry. International comparisons are also more useful and valid when sub-industry is held constant. Causal effects of a nation's training institutions on skills and*

*productivity can only be identified if sub-industry is held constant. The models for the studies that need to be done are the work of John Krafcik, John Paul MacDuffie and their colleagues on auto assembly plants around the world (Krafcik 1990, Krafcik and Macduffie 1989, Shimada and MacDuffie 1986, Macduffie and Kochan 1988), the study of computerized machine tools by Hartman and colleagues (1983), Ramchandran Jaikumar's (1986) study of flexible manufacturing in Japan and the United States and Marurice, Sellier and Silvestre (1986) comparison of French, German and British plants. Another excellent group of models for the research program are the intensive case studies of five industries--clothing, kitchen cabinet making, biscuit manufacturing, tool making and hotels--conducted by researchers associated with the National Institute of Economic and Social Research (NIESR) in London. These five case studies found that the British companies were less productive than their German and Dutch counterparts and concluded that the quantity and quality of occupational training received by young workers entering the industry was one of the primary causes of the differentials. These studies have had an enormous effect on the policy debate in the United Kingdom.*

*I propose three low cost ways of stimulating this kind of research. The most economical way for the Department of Labor to stimulate this kind of research is to fund PhD dissertations. A typical funding package might involve travel costs, 18 months of funding for the PhD student and one month of funding for a faculty member overseeing the project. Faculty time is a necessary part of the package because faculty can help gain access to companies and because their close guidance is needed. Since faculty guidance is so essential, the faculty sponsor's track record in this style of research becomes one of the criteria in making awards. Another criteria for awards should be letters of support from industry executives making commitments to give the researcher access. The RFP should provide a partial list of industries in which there is special interest but should also announce that other industries would be fine if the researcher has the necessary access and expertise. At the very top of the priority list should be flexible manufacturing (FMS). There would be very substantial benefits from returning to the FMS installations that Jaikumar visited in the early 1980s, collecting comparable data on the performance of these systems and analyzing the reasons for change. I have asked Jaikumar how difficult such a project would be, and he feels that, with his help, a graduate student could do*



*the job in a year and a summer. Because technology and management are held constant, multinational companies are a particularly interesting environment within which to do comparative studies. The RFP should therefore suggest that proposals for comparisons of plants located in different countries that are part of the same corporation would be particularly likely to receive favorable consideration.*

*The second economical approach to stimulating this kind of research is to offer to fund the American end of studies which have European or Japanese collaborators. At minimum an RFP should be issued proposing an American replication of the five NIESR studies--hotels, and manufacturers of clothing, kitchen cabinets, machinery and biscuits--that have had such an enormous effect on the policy debate in the United Kingdom.*

*TOOL MAKING--Daly, A., Hitchens, D.M.W.N., and Wagner, K., "Productivity, Machinery and Skills in a Sample of British and German Manufacturing Plants", National Institute Economic Review, February 1985, pgs. 48-60.*

*KITCHEN CABINETS--Steedman, Hilary and Wagner, Karin, "A Second Look at Productivity, Machinery and Skills in Britain and Germany", National Institute Economic Review, November 1987, Pgs. 84-94.*

*HOTELS--Prais, S.J., Karvis, Valerie, and Wagner, Karin, "Productivity and Vocational Skills Services in Britain and Germany: Hotels", National Institute Economic Review, November 1989, pgs. 52-74.*

*CLOTHING--Steedman, Hilary and Wagner, Karin, "Productivity, Machinery and Skills: Clothing Manufacture in Britain and Germany", National Institute Economic Review, May 1989, pgs. 40-57.*

*BISCUITS--....*

*For skilled occupations which require formal training in schools, a third economical way of making international comparisons of worker skills is to study the competency standards that are represented by the certification exams (Hollenstein 1983; Dore and Sako 1989). Researchers at NIESR have done a number of such studies comparing France, Germany and the United Kingdom and it would not be too difficult to add the United States to the sample (Prais 1981,1986, Prais and Wagner 1983, Prais and Steedman 1987, Steedman 1987,1989, Jarvis and Prais 1989). The approach I would recommend would be to compare NOCTI Student Occupational Competency Achievement Tests (SOCATs, both written and practical tests) and the Teacher Occupational Competency Exams (TOCATs) to the British City and Guilds exams and comparable French exams. Because the SOCATs have separate scores for up to 15 different aspects of the job, it should be possible to identify sections of the exam that are similar*

*to certain sections of the European exams to which they are being compared. Data exists at NOCTI on the SOCAT subtest scores obtained by Job Corps completers, high school vocational program graduates and completers of postsecondary vocational technical programs and on TOCAT test scores of experienced workers in the occupation who sought certification as vocational teachers.<sup>4</sup> This means that rough comparisons between US performance levels and British, German and French standards should be possible without having to arrange for NOCTI tests to be administered to random samples of US workers. In addition, some industries sponsor their own examination/certification systems (for more information contact Joan Wills at the Center for Workforce Development, 202-822-8405). Comparisons should also be made between these industry exams and their European counterparts.*

*An alternative approach would be to take the British City and Guild exams and derive from it an assessment that could be administered in the US and then administer it to small samples of US workers (City and Guilds of London Institute 1987). Either way, these studies could be expected to gain a great deal of attention to the issue of the quality occupational training in the U.S. This problem has not received the attention it deserves primarily because of the lack of good data on how our vocational students (both in high school and voc/tech colleges) compare to similar students abroad. It would be desirable to involve trade associations and unions in these studies by asking their members to participate as experts on the panels that make the comparisons. Once the studies are completed an effort should be made to involve them in the dissemination of the findings and in developing programs for responding to the findings.*

*My final recommendation is for the Department of Labor to assign an economist to the task of working with OECD and the World Bank (contact Hong Tan) on development of an instrument for surveying firms and enterprises about training. This survey should not focus solely on formal training. Informal training and learning-by-doing must receive equal attention. If one tried to collect information on the learning experiences and training activities of all workers in a medium sized establishment, the respondent burden would be incredible. The solution to this problem is to ask about the OJT and learning by doing experiences of just a few workers. If estimates of aggregate investment in training are desired, these workers must be selected*

