

A Note on Manpower Forecasting Commentaires sur la prévision des besoins en main-d'oeuvre

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Résumé de l'article

L'auteur de cet article étudie les différentes formules mises au point en vue de prévoir les besoins de main-d'oeuvre pour des catégories de travailleurs hautement spécialisés. Au fond, il s'agit de savoir s'il faut davantage accorder foi aux comparaisons touchant les gains, les taux de salaire escomptés et les ajustements du travail ou s'il est préférable de mettre l'accent sur la valeur comparative des métiers et des professions. Quelle que soit la formule utilisée, il est certain qu'elle comporte des lacunes qui la rendent illusoire en autant que l'aspect pratique de la prévision des besoins de main-d'oeuvre est concerné. On peut, à ce sujet, soulever les problèmes suivants : 1. Du côté de la demande, la question principale qui se souève à trait aux processus de substitution du capital au travail ou entre les différents types de travail ; 2. En ce qui regarde l'offre, il faut noter la difficulté de prédire le choix des métiers et la mobilité professionnelle ; 3. Pour ce qui est des marchés du travail et de la formation, la prévision n'est pas facile à cause des imperfections et des contraintes de la demande et de l'offre.

Même si dans le passé plusieurs économistes ont fait enquête sur les principaux facteurs qui déterminent les changements dans la productivité, il n'a pas été possible d'introduire ces changements en tant que variables dans l'analyse d'un système économique. Celui qui veut y aller des prévisions en matière de main-d'oeuvre doit être en mesure de prévoir les changements technologiques en corrélation avec la modification des facteurs strictement économiques de façon à préconiser les ajustements de main-d'oeuvre en conséquence. C'est là le premier critère dont il faut tenir compte.

Le deuxième élément nécessaire pour répondre à la demande, c'est la connaissance des procédés d'embauchage au niveau de l'entreprise. Ceux-ci, variant d'un employeur à l'autre, il est sûr que la prévision ne peut être que complexe. L'entreprise peut-elle substituer un technicien à un ingénieur, un manoeuvre à un ouvrier semi-qualifié, etc. ? Autant de faits qui dépendent de nombreux facteurs qu'on ne peut pas facilement cerner. Le degré de scolarité et de qualification exigé pour l'accès à un poste déterminé varie d'une entreprise à l'autre. On ne peut ignorer non plus le fait de la formation en atelier et de l'avancement par promotion. Dans certaines entreprises, on recourt à la main-d'oeuvre spécialisée au fur et à mesure des besoins. D'autres, au contraire, pratiquent une politique de main-d'oeuvre qui favorise les plans de carrière. Pour tous ces motifs, et bien d'autres encore, il s'avère donc qu'il soit fort difficile de faire des prévisions exactes à partir de la demande.

En ce qui concerne l'offre, selon l'auteur, on a accordé pas mal d'attention au niveau du chômage, aux taux de participation à la main-d'oeuvre et à la mobilité géographique des travailleurs, mais on est loin d'avoir fait des efforts comparables en ce qui a trait aux choix des métiers et des professions ainsi qu'à la mobilité professionnelle.

Ce qui existe se ramène à des hypothèses peu justifiées ou est exprimé en termes tellement généraux qu'on ne peut guère l'utiliser dans la prévision des besoins. Il est naturel que les personnes chargées de la prévision puissent disposer au moins de certains renseignements sur les choix professionnels qui ne le soient pas uniquement en fonction des taux de naissance, de mortalité et de participation.

Il peut y avoir une centaine de variables qui influent sur le choix d'un métier ou d'une profession. En réalité, la situation en ce qui touche l'offre oblige à connaître les raisons qui, cette fois à un niveau individuel, déterminent les processus décisionnels.

Les théories mises de l'avant en matière de capital humain laissent à désirer en tant qu'instrument général de prévision de l'offre en ce qu'elles ne font pas voir le lien entre les caractéristiques observables et les avantages d'emploi et l'idée que s'en font les individus et ce qu'ils espèrent en retirer dans la réalisation de leur carrière.

On a sans doute fait des recherches sur les variables techniques, économiques, institutionnelles et personnelles qui influencent l'offre de travail, mais il s'agit presque toujours de considérations hypothétiques. Il faudrait disposer d'une théorie plus solide de l'offre qui permettrait de considérer les choix travail-loisir, les revenus espérés en rapport avec la décision de se spécialiser ou de changer d'emploi, le rôle des orienteurs, les renseignements diffusés sur la nature des emplois, les politiques de recrutement et d'embauchage, la formation en atelier. Outre les variables strictement démographiques, il faudrait avoir des renseignements sur la persistance des individus dans tel ou tel emploi, alors que les travaux préliminaires entrepris concernant l'usure des effectifs semblent indiquer que ce n'est pas là une tâche très facile.

En troisième lieu, l'auteur signale que la connaissance des rapports fondamentaux entre la demande et l'offre de travail ne suffirait pas à mettre au point une méthode assurée de prévision. Il faut en outre pouvoir maîtriser les forces et les mécanismes agissant à l'intérieur des marchés du travail. Cela force à se poser un certain nombre de questions relativement au déphasage et aux imperfections des marchés qui peuvent influencer la prévision. On pourrait aussi s'interroger sur les effets des modifications de programmes d'éducation sur la composition de la main-d'oeuvre. Il y aurait également lieu d'établir certaines hypothèses relativement aux changements qui se produisent dans l'utilisation du travail : modification de la semaine de travail, des cadences de travail, des périodes de vacances. On pourrait encore ajouter à cette longue énumération.

Il faudrait, enfin, penser à la création d'organismes composés d'ingénieurs industriels, de directeurs du personnel et d'experts qui faciliteraient le travail de prévision. Non seulement l'établissement de tels organismes permettrait-il de mettre en commun les données, mais il pourrait servir de moyens de communication auprès du public. On pourrait aussi procéder à des études sur les plans de carrière et sur certains groupes d'emplois en particulier, études qui seraient très utiles et pourraient conduire à la mise au point de techniques plus valables que les instruments dont disposent actuellement les spécialistes en matière de prévision des besoins en main-d'oeuvre.

COMMENTAIRES

A NOTE ON MANPOWER FORECASTING

Klaus Weiermair

Repeated supply and demand imbalances in the markets for particular groups of highly skilled labour (as has been observed in the Canadian setting with respect to engineers, managers or teachers over the last decade), and the government's increasing concern with rising education budgets should certainly renew efforts in the use of econometric models for the purpose of manpower forecasting and manpower planning the near future.¹ Such exercises, it is often claimed, provide the most operational basis for manpower forecasts or predictions (or hybrids thereof) and hence give educational authorities more preparatory lead-time for planning and decision making.

Although earlier criticism with various attempts and models of manpower forecasting and manpower planning have not gone entirely unnoticed² it seems as if little progress has been achieved with the more fundamental and conceptual problems of such exercises. In the following some of these key problems are discussed with the suggestion of pursuing some of these inquiries along alternative lines.

Much of the debate on the usefulness of various methods of assessing and predicting future states of manpower and education have centered around the question as to whether more reliance should be placed on relative earnings comparisons, predicted rates of return and the market adjustments for various types of labour or whether the better alternative

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I would like to thank Steven Globerman, Associate Professor, Faculty of Administrative Studies for useful comments received on an earlier version of this note.

¹ Recent efforts of this kind can be found in almost any country. For a Canadian reference see: B. AHAMAD, *A Projection of Manpower Requirements by Occupation in 1975*, Ottawa, Department of Manpower and Immigration, Research Branch, 1968.

² For two excellent critics of manpower forecasting exercises, see: R. G. HOLLISTER, *A Technical Evaluation of the First Stage of the Mediterranean Regional Project*, Paris, OECD, 1966; M. BLAUG, *An Introduction to the Economics of Education*, London, The Penguin Press, 1970, pp. 146-168.

lies in the construction of various skill and educational coefficients and their projections via the use of an input-output model or related techniques.³ The literature has accumulated a long list of criticism and objections to either approach and on balance it appears that neither one can claim superiority. Some economists have, therefore, concluded that it might be wisest to use them both simultaneously in order to narrow the risk of error.⁴

What partially accounts for the incomparability of forecasting models suggested or in use is that they have not as yet allowed much empirical validation and follow up, and even if efforts were undertaken in this direction performance tests might not be very meaningful given the great variation in techniques and objectives of such studies.⁵

Quite apart from the gross benefits that each approach seems to offer and these are often strongly defended by its originator, all existing models share a list of conceptual deficiencies in common, which make them equally unrealistic as far as the practical side of the manpower forecasting exercise is concerned. Among them, the following problem and issues are taken up here :

- 1) On the demand side of the manpower projection the key question concerns substitution processes between capital and labour or between different types of labour within the frame of manpower projections.
- 2) On the supply side, unsolved issues relate to the indeterminacy of occupational choice and occupational mobility.
- 3) With respect to markets for labour and education, a great many problems for forecasting arise out of assumptions of present and evolving imperfections and constraints on either the demand or supply side. The difficulties are compounded by the stochastic character of the production process and the investment in human capital process.

Ad 1) Although a number of economists have investigated major determinants of productivity and productivity changes⁶ in the past, it has so far not been possible to incorporate the process of technological change

³ Under very special circumstances of a given equilibrium steady state trajectory, one set of factors would simply be a transformation of the others. For a discussion see : M. BLAUG, *An Introduction...*, *Ibid.*, p. 214.

⁴ M. BLAUG, « Approaches to Educational Planning, » *Economic Journal*, June 1967, pp. 263-287.

⁵ This partly stems from the fact that projections are made for intercensus target years, partly it is the result of high aggregations which, due to wash-out effects, escape careful evaluations.

⁶ For example : E. F. DENISON, *The Sources of Economic Growth in the United States and the Alternatives before us*, New York, C.E.D., 1962.

itself as an endogenous variable into an economic system or model, which is to say that we are still short of a unified theory of technology and its economic impact.⁷ For the manpower forecaster some vision of technological change becomes necessary because of its associated manpower implications. Presumably he is interested in knowing what kind of technological changes might occur over the forecasting period, what kind of manpower adjustments these might entail and what the timing and total effects might look like. If he is concerned, in addition with the dynamic links between technological change and economic factors, he may consider the simultaneity between manpower and technology, that is, to what extent and in what form does the pricing and distribution of skills influence technological change and how does this in turn alter the composition of manpower.

The second critical area on the demand projection side that requires at least some thoughtful extensions deals with the whole question of employment processes at the level of the firm, particularly mechanisms and linkages of external and organization-internal labour markets. While it cannot be denied that organizations regard prices that they pay for various types of labour as important and while at least in the short run certain technological constraints or labour input-product output relationships can be binding to the firm or organization there is mounting evidence⁸ to believe that the process of employment may be a little bit more complicated involving more dimensions and longer stretched planning horizons on the part of the firm than is usually assumed in traditional economic models dealing with the employment and pricing of labour.⁹ It appears that hiring standards with respect to educational and occupational background as well as labour compensation may be only two out of several employment instruments, which can be varied by the employer. In addition he may be able to adjust his labour force through a variety of training and promotion schemes. As a consequence, employers particularly if they are large and have promotional flexibilities and training possibilities will consider employment from a longer point of view, in which longitudinal career patterns and associated productivity curves become of greater concern than the mere equation of current marginal productivity and compensation or the determination of the occupational and educational standard of the job holder at entry into the firm. This is even more so true in those cases where labour has become a fixed or quasi-fixed

⁷ R. L. HEILBRONER, « The Impact of Technology : The History Debate, » in J. T. Dunlop (ed.), *Automation and Technological Change*, Englewood Cliffs, N.J., Prentice Hall, 1962.

⁸ See, for example, Peter B. DOERINGER, and Michael J. PIORE, *Internal Labour Markets and Manpower Analysis*, Lexington, Mass., D. C. Heath and Company, 1971.

⁹ For an exposition see : Allan M. CARTER, *Theory of Wages and Employment*, Homewood, Ill., Irwin Inc., 1959.

factor.¹⁰ The simultaneity of the decision instruments in the employment process indicates however, among other factors to be taken into account, that no unique relationship between final demand and some specified manpower or educational structure should be expected. And this is what has been demonstrated in so many studies of this kind that have related output to manpower input be it now at the national, the industrial or the firm level.

The difficulties of accurately specifying a country's manpower requirements with respect to distinct classes of manpower for a particular target year in the future can probably be best appreciated when viewed from within the decision-making process and planning horizons in which decision-making units are involved at the manpower demand side. The question then reads: «What determines the educational and occupational structure of a firm's work force and how are employers likely to change their manning requirements as a result of some specified exogenous or endogenous changes such as production-, sales-, or productivity-growth, changes in the size of operation, product diversification, changes in factor prices. The exploration and specification of economic relationships between the firm's occupational and/or educational structure of its work force and the forementioned observations necessitates unfortunately a very thorough knowledge of production functions and underlying production processes particularly with respect to substitutabilities and complementarities between classes of manpower and manpower and capital. It is usually at this point that both empirical and theoretical analyses break down and for obvious reasons. Whether or not a firm can substitute a technician or technologist for an engineer, an unskilled for a semi-skilled labourer, an individual with grade 12 for a worker with a college degree and to what extent classes of manpower and manpower and capital will have to be employed in fixed proportions depends on a host of factors, which furthermore, appear to vary greatly among firms and industries and which are only directly and very faintly influenced by traditional market mechanisms. Management styles, philosophies and institutional arrangements with respect to personnel on the one hand firm size, technology and the associated extent of labor division and specialization on the other hand appear to be the main reasons for such varying manpower substitution and complementarity pattern observed. Firms, for example, who mainly hire through entry ports, promote from within the organization, have large and effective training functions along with the existence of numerous narrowly graded jobs and job districts and who on top view employees' contributions from a long term (career) perspective will display an entirely different feasibility set of manpower

¹⁰ While, following Becker's lead, advances have been made concerning the interdependency of training, employment and compensation, most such models are still confined to the comparative static variety and as a rule can empirically be tested only through indirect methods. For a recent example see: Donald O. PARSONS, «Specific Human Capital, An Application to Quit Rates and Lay-off Rates,» *JPE*, November/December 1972, pp. 1121-1143.

substitutions than a firm or organization, which possesses less and more broadly defined job districts, that has less promotional flexibility, that provides no or little training and that hires mainly from the open external labour market. It could now be argued that such differences in personnel policies and internal labour market arrangements are merely a correlate of the firm size and technology employed. To a certain degree, size and technology will undoubtedly dictate such aspects as work specialization, work lay-outs and job-gradations and hence indirectly influence manning requirements. Managements' skills and attitudes in the personnel area still play a very large part in determining both the feasibility and realization of manpower substitutions across jobs, job clusters and occupations within the organization. Only under conditions of very hard competition in both product and factor markets would personnel strategies become standardized across firms and industries for reasons of competitive survival. In the meantime inter-firm differences in perceptions of manpower strategies and in the effective utilization of manpower are likely to persist with the given competitive environment in which most firms operate today. There have been at least three empirical studies which directly or indirectly have dealt with the role of manpower substitutions at the firm or industry level and which seem to support these arguments. The first one undertaken by the « Higher Educational Research Unit » of the London School of Economics was an interplant study of the Electrical Engineering Industry, which sat out to obtain meaningful economic relationships between certain high level manpower categories as input measures and a variety of output measures and firm characteristics variables.¹¹ The study which was excellently executed and which had a great wealth of quantitative measures to work with¹² found very little in terms of stable and predictable relationships of one sort or another.

The great variations in occupational and educational structures observed among firms could only marginally be accounted for by a battery of output, performance and firm characteristics measures (the highest \bar{R}^2 of various multiple regressions was in the order of .30). The only independent observations which were statistically significant at all were firm size and technology employed. The results were similarly poor for the specification and estimation of cross-sectional production functions where manpower was entered as a qualitative variable. No clear cut patterns of substitutability and/or complementarity between manpower categories and manpower and capital were detected.

The second piece of research of rather series of empirical studies related to problems of substitutions within the context of manpower forecasting is the work associated with P. Doeringer, M. Piore and J.

¹¹ P. R. G. LAYARD, J. D. SARGAN, M. E. AGER and D. J. JONES, *Qualified Manpower and Economic Performance, An Inter-plant Study of the Electrical Engineering Industry*, Allen Lane, London, The Penguin Press, 1971.

¹² The study unfortunately did not collect any qualitative information on organization-internal labour markets, personnel policies, etc.

Scoville.¹³ A great many of their studies have shown the process and the means by which firms and industries adjust their work-force in response to changing conditions particularly with respect to technologies and labour markets. As distincts from the LSE piece of research which worked with manpower stocks of the highly qualified category these studies are primarily concerned with allocation processes of the blue collar-type manpower over time. While at times they may lack the elegance and precision of the former econometric approach, they do nevertheless contain very useful insights into manpower management practices at the firm and industry level coming up with positive answers regarding the planning horizons and decision making processes of firms with respect to the employment and utilization of specified classes of manpower. According to these authors differences in the occupational/educational structure are the result of differences in the planning and forecasting horizons of firms concerning expected manpower imbalances and the means of dealing with these problems on the one hand and constant work force adjustments following shift in technology and labour market changes through variations in hiring standards, screening procedures, on-the-job training and job design on the other hand, produce a situation which « defies any analysis, that depends upon discrete manpower categories. »¹⁴ While the last statement may be overly pessimistic it nevertheless indicates the enormous difficulties involved in tracing through demand changes over time, which can be accommodated by a variety of mechanisms among which wage adjustments is but one and probably not even the most important one. The latter aspect is also brought out in the third study to be mentioned here, which looked at manpower substitutions in the field of technical manpower in Canada.¹⁵ Similar to the studies on work force adjustments in the U.S. manufacturing sector, the authors found that wages and relative manpower supplies were a minor

¹³ In particular see : P. B. DOERINGER, M. J. PIORE and J. G. SCOVILLE, « Corporate Manpower Forecasting and Planning, » reprinted in Elmer BURAK and J. W. WALKER (eds.), *Manpower Planning and Programming*, Boston, Allyn and Bacon, 1972, pp. 111-121 ; M. PIORE, « The Impact of the Labour Market Upon the Design and Selection of Productive Techniques Within the Manufacturing Plant, » *The Quarterly Journal of Economics*, Vol. LXXXII, No. 4, November 1968, pp. 602-620 ; M. PIORE, « On the Job Training and Adjustment to Technological Change, » *The Journal of Human Resources*, Vol. III, No. 4, Fall 1968, pp. 435-449 ; P. DOERINGER, « Determinants of the Structure of Industrial Type Labour Markets, » *Industrial and Labour Relations Review*, Vol. 20, No. 2, January 1967, pp. 206-220 ; P. DOERINGER and M. PIORE, *Internal Labour Markets and Manpower Analysis*, Lexington, Mass., Heath-Lexington, 1971 ; U.S. Department of Labour, *Work Force Adjustments in Private Industry — Their Implications for Manpower Policy*, Research Monograph No. 7, Washington, 1968.

¹⁴ U.S. Department of Labour, *Ibid.*, p. 120.

¹⁵ M. L. SKOLNIK and W. F. McMULLEN, « An Inquiry into Substitution between Engineers and Technologists, » Report submitted to the Committee of Presidents of Universities of Ontario, November 1970.

determinant for decisions to substitute between manpower and capital or between particular manpower categories, in this case between technicians and engineers. Substitutions the study furthermore showed could be carried out along various possible dimensions in terms of educational, career and work-function content of jobs and occupations. In the field of technical manpower work function, type substitutions involving job redesigns after technological changes seemed to dominate. While obviously substitutions could only have been accommodated with an enlarged supply of technicians, it became clear from the study that the elasticity of substitution was a rather complex function of a variety of technical, behavioural, institutional and economic considerations,¹⁶ which in turn appeared to vary among firms and industries and which are changeable over time.

Consequently, manpower projections and/or forecasts which undertake to translate projected changes in national income into industrial employment, occupational structure and subsequent manpower requirements in terms of occupations or education will in all likelihood prove to be poor forecasting estimates for all of the reasons given above. Quite apart from possible price effects they neglect important adjustments in staff arrangements, which the firm may undertake in response to changes in its size and technology and which can be arranged through a variety of policy shifts with respect to recruiting, training and job-design.

To argue that the observed existing variability in the occupational or educational structure of an industry or employment sector may be conceived as a pure random phenomenon with distinct probability distributions¹⁷ which subsequently could be utilized for refining occupational or educational forecasts does still not help in solving questions about the endogenous character of manpower substitutions. A sensitivity analysis based on probability notions does however introduce greater flexibilities into the forecasting exercise by demonstrating the relative strength of particular forecasting assumptions.

Instead the pattern of manpower adjustment in the face of technological change as well as internal labour allocations in large organizations point to long-run substitution processes and pattern of labour allocation, which so far, have been inadequately explained by economic theory and which can scarcely be rationalized by more sophisticated and refined manpower projection methods.

Ad 2) While certain labour supply aspects such as the question of unemployment, labour force participation or geographical and industrial

¹⁶ Economic and technical factors are usually dealt with explicitly however, very often behavioural and institutional factors which may impede skill substitution such as social resistance, difficulties of institutional re-organization or open and hidden licensing practices may be the more important determinants of substitutions.

¹⁷ B. AHAMAD and K. F. SCOTT, « A Note on Sensitivity Analysis in Manpower Forecasting, » *J. Royal Statistical Soc.*, 135(3) 1972, pp. 385-392.

mobility have traditionally received a great amount of attention by economists, the more fundamental issues of occupational choice and occupational mobility have scarcely seen comparable efforts and results from either a theoretical or empirical point of view. What exists so far on the theoretical side is either too much restricted by undue assumptions¹⁸ or kept in such general terms¹⁹ that it can be of no use in manpower forecasting. Case studies and case histories on occupational decisions²⁰ on the other hand have merely indicated the general dimensionality of the problem but have again not allowed the construction of a well oriented theory of labour supply. The reason why manpower forecasters would like to have at least some basic information on occupational choice is obvious. Manpower supplies are not mere functions of birth, mortality and labour force participation rates which in conjunction with certain assumptions about the educational sector provide for an overall magical mathematical formula for supply projections. In reality, there may be as many as a hundred or more independent variables which affect occupational choice and hence, relative labour supplies as most manpower forecasters would candidly admit. The issues on the supply side are similar to the previous discussions of demand factors in the sense that they too require clarifications concerning the determination of decision making processes, in this case, at the level of the individual with respect to his choices and evolving pattern of occupational and educational careers. While Becker's path-breaking work on investments in human capital²¹ has provided a broad theoretical framework for analyzing choice problems of labour input suppliers with respect to the forementioned human capital formation, much more needs to be added to this theory in order for it to become a generalized decision theory of occupational choice. Among the factors which so far have not or only inadequately been built into Human Capital Theory are questions of interdependencies between various sequences of human capital investments in general and relationships between formal and informal types of training and education in particular as well as choice problems concerning different modes of human investment sequences or possible career path patterns over time. The most serious drawback of human capital theory as a general tool for an analysis of manpower supplies stems however from the fact that it does not provide a rigorous enough causal link between given observable characteristics and assets of jobs and occupations, individual perceptions and expectations concerning those characteristics and the individual's decision making process concerning careers. Many of the technical institutional

¹⁸ Malcolm R. FISHER, « Selection of Skill, Training and Occupational Mobility », *The Manchester School of Economics and Social Studies*, 1968, pp. 111-130.

¹⁹ S. ROTTENBERG, On Choice in Labour Markets, *Ind. Labour Rel. Rev.*, Vol. 9, 1956, pp. 183-199.

²⁰ E. GINZBERG, *The Development of Human Resources*, New York, McGraw-Hill, 1966.

²¹ G. BECKER, *Human Capital, A Theoretical and Empirical Analysis with Special Reference to Education*, New York, Nat. Bur. Econ. Res., 1964.

behavioural and economic variables which effect manpower supplies have been investigated, albeit almost always under steady state (*ceteris paribus*) assumptions. What is needed is a more robust theory of labour supply which could handle such aspects as labour/leisure choices, expected economic returns to educational and occupational decisions and their expected variability, job information, guidance and counselling effects, recruitment and hiring policies, on-the-job training and job design etc., simultaneously; a desideratum of considerably tall order indeed. More modestly and in line with the more global character of occupational forecasting what the manpower planner/forecaster needs in addition to key demographic variables are statistics which would tell him with some degree of accuracy the average survival rate of individuals in particular occupations. Equipped with this type of information, supply forecasts should become easier. Preliminary work on the question of attrition rates in particular occupations²² seems to indicate however, that getting at the dimensionality of survival rates is by no means an easy task and certainly involves more than merely looking at occupational wage differences. The task is compounded by the fact that existing statistics only allow decennial comparisons, which may prove quite inadequate, for the purpose of testing the stability of attrition rates and hypotheses concerning occupational mobility.

Ad 3) Knowledge of key relationships on both the labour demand and labour supply side though necessary, however, do not guarantee in themselves, a successful forecasting model. Additional requirements are notions of various adjustment forces and mechanisms of labour markets as well as institutional insights concerning manpower allocations over the period of the projection. This involves asking such questions as the nature of time lags in particular labour markets or the impact that various types of market imperfections might have on the forecast. If, for example, income and income differences were found to be the crucial variable explaining occupational choice, how long would it take for departures in income differences to have a pronounced impact on the supply of various types of skills and educated labour? How would this change if more information on occupational income were to become available, as it presumably will with the ever-increasing details of income statistics.

While generalizations about labour market adjustment processes such as those provided by Blank and Stigler²³ or Capron and Arrow²⁴ certainly provide an overall understanding of global market forces. they may

²² Mark B. SCHUPACK, « Changes in Occupational Structure » in M. J. Brennan, (ed.), *Patterns of Market Behaviour*, Rhode Island, Brown University Press, 1965.

²³ David M. BLANK and George J. STIGLER, *The Demand and Supply of Scientific Personnel*, New York, Nat. Bur. Econ. Res., 1957.

²⁴ Kenneth J. ARROW and William M. CAPRON, « Dynamic Shortages and Price Rises : The Engineering-Scientist Case, » *Quarterly Journal of Economics*, Vol. 73, No. 2, May 1959, pp. 292-308.

prove to be quite inoperational in analyzing dynamic manpower shortages as recent empirical work has shown.²⁵

Other questions would, i.e. center around the manpower effects of changes in the educational sector. How would newly emerging school types, degree programmes, changes in skill labeling or job dilution procedures affect labour allocations? Or, what will happen to both the supply and demand pattern of various skills over time as a consequence of the firm's increasing role in industrial and other types of training? A complete forecast would furthermore have to make certain assumptions about changes of labour utilization, which are likely to occur over the forecast period in such areas as alteration of work weeks, and work pace, or expected changes in allowed vacation time. Since it has so far not been possible to disentangle the impact of such factors on the present level of labour utilization, it is doubtful whether more than educated guesses can be made about future states.

There are, no doubt, many more qualifications which could be added to the already long list, causing even stronger reservations with the sole use of econometric techniques in manpower forecasting and planning exercises. At least some improvements could be made by moving into different directions with respect to the collection of manpower information and with respect to the theoretical treatment of labour force adjustment processes.

With respect to the former one way to better handle indeterminacies of technological shifts and their expected and concomitant manpower changes and to throw more light on adjustment processes in the firms' internal labour markets would be to employ inductive planning techniques similar to the ones which have been developed in France.²⁶ This would imply that manpower forecasts would be interpreted and corrected through a body, composed of industrial engineers, personnel managers and industry experts to be set up under the auspices of those governmental units, which are in charge of such manpower forecasting and planning exercises. The establishment of such a committee would not only offer the advantages of effectively pooling knowledge about ongoing and expected manpower adjustments at the firm and industry level²⁷ but it could also be used as a communication and possibly policy implementation vehicle with regards to federal manpower planning activities.²⁸

²⁵ Walter FRANKE and Irvin SOBEL, *The Shortage of Skilled and Technical Workers*, Lexington, Mass., Heath and Company, 1970.

²⁶ John and Anne-Marie HACKETT, *Economic Planning in France*, Cambridge, Mass., Harvard University Press, 1963.

²⁷ A good discussion of longer-term forecasting of technological changes and their techniques, which could also be of relevance in the manpower field can be found in: Jantsch ERICH, *Technological Forecasting in Perspective*, Paris, OECD, 1967.

²⁸ J. SHEAHAN, *Promotion and Control of Industry in Postwar France*, Cambridge, Mass., Harvard University Press, 1963.

On the supply side of the manpower equation more use should be made of special surveys and studies dealing with the longitudinal character of career patterns and some though limited efforts are beginning to emerge in this country.²⁹ In addition, frequent special inquiries into the operations of labour markets for particular occupations or occupational groupings might prove useful for both the manpower forecaster and those labour economists who wish to overhaul and improve classical theories on the employment function. Hopefully within such a revised theory firm or industry demand for labour of various types will become viewed as a « long-term or multi-period allocation process under the existence of dual labour markets » thereby not only making a more meaningful analysis and projection of labour demand possible, but at the same time providing also generalizations on occupational mobility on the basis of typical career-path patterns within organizations. Efforts to amalgamate institutional theories of internal labour markets with notions of job design, training, human capital and the remaining neoclassical framework of employment and wages are now emerging.³⁰ Inquiries of this kind will eventually not only lead to a fully satisfactory dynamic model of employment, jobs and training but should also give the manpower forecaster a better grasp and understanding of some of the underlying determinants and key processes of various types of labour mobility, concepts which so far have been nightmares to manpower forecasters. Given the fact that most industrialized nations are faced with rapid technological changes and given our still inadequate knowledge of such processes it might therefore very well pay off to employ relatively more resources in the investigation of these technological changes and works force adjustments following those changes at the industry and firm level. Such micro-foundations of manpower changes and manpower adjustments would ultimately also allow more refined forecasting techniques at the aggregate level and would stand on much more solid theoretical grounds than some of the existing forecasting devices which have been used so far.

Commentaires sur la prévision des besoins en main-d'oeuvre

L'auteur de cet article étudie les différentes formules mises au point en vue de prévoir les besoins de main-d'oeuvre pour des catégories de travailleurs hautement spécialisés. Au fond, il s'agit de savoir s'il faut davantage accorder foi aux comparaisons touchant les gains, les taux de salaire escomptés et les ajustements du travail ou s'il est préférable de mettre l'accent sur la valeur comparative des métiers et des professions. Quelle que soit la formule utilisée, il est certain qu'elle

²⁹ Career patterns of university graduates are currently being investigated in Canada via the use of a post-censal survey, *Highly Qualified Manpower Survey*, Ministry of State, Ottawa.

³⁰ James G. SCOVILLE, « A Theory of Jobs and Training, » *Industrial Relations*, Vol. 9, No. 1, October 1969, pp. 36-53.

comporte des lacunes qui la rende illusoire en autant que l'aspect pratique de la prévision des besoins de main-d'oeuvre est concerné. On peut, à ce sujet, soulever les problèmes suivants : 1. Du côté de la demande, la question principale qui se soulève a trait aux processus de substitution du capital au travail ou entre les différents types de travail ; 2. En ce qui regarde l'offre, il faut noter la difficulté de prédire le choix des métiers et la mobilité professionnelle ; 3. Pour ce qui est des marchés du travail et de la formation, la prévision n'est pas facile à cause des imperfections et des contraintes de la demande et de l'offre.

Même si dans le passé plusieurs économistes ont fait enquête sur les principaux facteurs qui déterminent les changements dans la productivité, il n'a pas été possible d'introduire ces changements en tant que variables dans l'analyse d'un système économique. Celui qui veut y aller des prévisions en matière de main-d'oeuvre doit être en mesure de prévoir les changements technologiques en corrélation avec la modification des facteurs strictement économiques de façon à préconiser les ajustements de main-d'oeuvre en conséquence. C'est là le premier critère dont il faut tenir compte.

Le deuxième élément nécessaire pour répondre à la demande, c'est la connaissance des procédés d'embauchage au niveau de l'entreprise. Ceux-ci, variant d'un employeur à l'autre, il est sûr que la prévision ne peut être que complexe. L'entreprise peut-elle substituer un technicien à un ingénieur, un manoeuvre à un ouvrier semi-qualifié, etc. ? Autant de faits qui dépendent de nombreux facteurs qu'on ne peut pas facilement cerner. Le degré de scolarité et de qualification exigé pour l'accession à un poste déterminé varie d'une entreprise à l'autre. On ne peut ignorer non plus le fait de la formation en atelier et de l'avancement par promotion. Dans certaines entreprises, on recourt à la main-d'oeuvre spécialisée au fur et à mesure des besoins. D'autres, au contraire, pratiquent une politique de main-d'oeuvre qui favorise les plans de carrière. Pour tous ces motifs, et bien d'autres encore, il s'avère donc qu'il soit fort difficile de faire des prévisions exactes à partir de la demande.

En ce qui concerne l'offre, selon l'auteur, on a accordé pas mal d'attention au niveau du chômage, aux taux de participation à la main-d'oeuvre et à la mobilité géographique des travailleurs, mais on est loin d'avoir fait des efforts comparables en ce qui a trait aux choix des métiers et des professions ainsi qu'à la mobilité professionnelle.

Ce qui existe se ramène à des hypothèses peu justifiées ou est exprimé en termes tellement généraux qu'on ne peut guère l'utiliser dans la prévision des besoins. Il est naturel que les personnes chargées de la prévision puissent disposer au moins de certains renseignements sur les choix professionnels qui ne le soient pas uniquement en fonction des taux de naissance, de mortalité et de participation.

Il peut y avoir une centaine de variables qui influent sur le choix d'un métier ou d'une profession. En réalité, la situation en ce qui touche l'offre oblige à connaître les raisons qui, cette fois à un niveau individuel, déterminent les processus décisionnels.

Les théories mises de l'avant en matière de capital humain laissent à désirer en tant qu'instrument général de prévision de l'offre en ce qu'elles ne font pas voir

le lien entre les caractéristiques observables et les avantages d'emploi et l'idée que s'en font les individus et ce qu'ils espèrent en retirer dans la réalisation de leur carrière.

On a sans doute fait des recherches sur les variables techniques, économiques, institutionnelles et personnelles qui influencent l'offre de travail, mais il s'agit presque toujours de considérations hypothétiques. Il faudrait disposer d'une théorie plus solide de l'offre qui permettrait de considérer les choix travail-loisir, les revenus espérés en rapport avec la décision de se spécialiser ou de changer d'emploi, le rôle des orienteurs, les renseignements diffusés sur la nature des emplois, les politiques de recrutement et d'embauchage, la formation en atelier. Outre les variables strictement démographiques, il faudrait avoir des renseignements sur la persistance des individus dans tel ou tel emploi, alors que les travaux préliminaires entrepris concernant l'usure des effectifs semblent indiquer que ce n'est pas là une tâche très facile.

En troisième lieu, l'auteur signale que la connaissance des rapports fondamentaux entre la demande et l'offre de travail ne suffirait pas à mettre au point une méthode assurée de prévision. Il faut en outre pouvoir maîtriser les forces et les mécanismes agissant à l'intérieur des marchés du travail. Cela force à se poser un certain nombre de questions relativement au déphasage et aux imperfections des marchés qui peuvent influencer la prévision. On pourrait aussi s'interroger sur les effets des modifications de programmes d'éducation sur la composition de la main-d'oeuvre. Il y aurait également lieu d'établir certaines hypothèses relativement aux changements qui se produisent dans l'utilisation du travail : modification de la semaine de travail, des cadences de travail, des périodes de vacances. On pourrait encore ajouter à cette longue énumération.

Il faudrait, enfin, penser à la création d'organismes composés d'ingénieurs industriels, de directeurs du personnel et d'experts qui faciliteraient le travail de prévision. Non seulement l'établissement de tels organismes permettrait-il de mettre en commun les données, mais il pourrait servir de moyens de communication auprès du public. On pourrait aussi procéder à des études sur les plans de carrière et sur certains groupes d'emplois en particulier, études qui seraient très utiles et pourraient conduire à la mise au point de techniques plus valables que les instruments dont disposent actuellement les spécialistes en matière de prévision des besoins en main-d'oeuvre.