OCCASION

This publication has been made available to the public on the occasion of the 50th anniversary of the United Nations Industrial Development Organisation.

DISCLAIMER

FAIR USE POLICY

CONTACT

Please contact publications@unido.org for further information concerning UNIDO publications.

For more information about UNIDO, please visit us at www.unido.org

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria
Tel: (+43-1) 26026-0 · www.unido.org · unido@unido.org

We regret that some of the pages in the microfiche copy of this report may not be up to the proper legibility standards, even though the best possible copy was used for preparing the master fiche.

United Nations
Centre for Industrial Development

Original: English

Inter-Regional Symposium on Industrial Project Evaluation

CID/IPE/B.4
Discussion Paper

Prague, Czechoslovakia
11 - 29 October 1965

07587

SKILL REQUIREMENTS IN MANUFACTURING INDUSTRIES

Prepared by: Manuel Zymelman
Northeastern University

for: The Centre for Industrial Development
Department of Economic and Social Affairs
United Nations

65-40577

TABLE OF CONTENTS

Introduction

1. Given the rapid population growth that is common in many underdeveloped regions of the world, no developing nation has available the choice between subsistence and modernization, but only between modernization and starvation. In such nations salvation is generally seen in the form of economic development. And, in most situations, the development goal has taken on the form of industrialization.

2. Industrialization for almost all developing nations means a sharp break with the past. Certain trends may continue in some sectors, but the major thrust of industrialization involves a new direction in the forward movement of various economic sectors. The process of industrialization, however, is exceedingly complex, and few nations have succeeded in attaining industrialization in a brief period of time.

3. Few developing nations will find much in their past economic development to help them plan rapid industrial growth. And, even where the past trend could assist in the construction of plans for the future, few developing nations would have sufficient useable statistics to compute an accurate trend. Economic plans are too frequently constructed with no sound statistical basis.

4. But, if relatively rapid progress is to be made down the road to industrialization, some planning must take place. This is clearly recognized by most developing nations as they construct general economic plans for their industrialization. The more realistic plans take into account manpower as an important factor for economic development.

5. Nevertheless, too few economic planners consider human resources as a major factor in the development process. Only in recent years has greater emphasis been placed on this factor and knowledge of this factor is still rather limited.

6. Clearly; however, the human resources factor must be fitted into any general economic plan. And projection of future manpower requirements within the framework of a general economic plan requires that projected industrial output be related to the manpower required to produce that level of output. This cannot be done when no relevant past statistics exist to determine a trend, or when the industry itself has not existed. Alternatives must be found.

7. When an industry or economic sector already exists, one such alternative is to project future manpower requirements of the whole industry from the occupational structure of the most modern plants. India, for example, has used this procedure in its plans for development of some industries. For many other industries, however, this procedure was apparently not considered appropriate, and was not used. Other nations have undoubtedly used this approach in estimating future manpower requirements for expanding sectors of their economies.

8. Another alternative open to all developing nations, as well as fully developed nations, is to use as a guide the quantitative data from other nations. This approach was used by the planning and developing agencies of Puerto Rico in its "operations bootstrap". Puerto Rico assumed that the major sectors of

the economy in 1975 would approximate the productivity levels of the United States in 1950, with the distribution of employment following a similar pattern. Perhaps data for other nations would have been more appropriate but there was no real choice; no statistics in any way reasonably comparable were available. Despite the disparate levels of economic development between Puerto Rican industries and United States industries, the comparisons were used, and with considerable success. But, few other nations felt sufficiently comfortable to use United States manpower statistics as the guide for economic planning.

9. There are few experts or writers in the field of manpower and human resources development who do not recognize international comparisons as a basic method of making manpower projections. Their use has been limited because the relevant data have not been collected, analyzed, and made available in useful form to the developing nations of the world. Inevitably, the indication of the international comparison method of manpower projections as a valuable approach is footnoted with the <u>caveat</u> that the necessary data are not available.

10. In this current report, we are presenting preliminary statistics on manpower for a series of selected countries at different levels of economic development. It is assumed that data for countries at different levels of economic development represent different levels of technology, broadly defined to include such factors as size of establishment. From such an array of data, presented by industry or economic sector, a developing nation can select one set of statistics as its target for some future level of development. The greater the number of nations represented in our continuum, the greater the likelihood that a developing nation can find the set that most closely matches its desired level of development. While it is possible for a nation to interpolate between sets of data, steps between relevant data should [illegible] as narrow as possible in order to minimize errors.

11. The basis for this approach of manpower projections is the following hypothesis:

> "Since a given skill composition reflects a given state of technology, (and hence productivity), there is a <u>direct</u> relationship between value added per employed person in a given industry and the skill composition of the workforce in the same industry."

12. This hypothesis was tested by the use of statistics available for the various states of the United States. There is sufficient basis to presume that the relationship exists. While the relationship has not yet been tested for various nations, there are indications that the relationship will hold.

13. This report is a preliminary statement based on a vast research project by Professors Manuel Zymelman, Irwin L. Herrnstadt, and Morris A. Horowitz of the Economics Department of Northeastern University, Boston. The research is being conducted under the sponsorship of the Bureau for Latin America of the Agency for International Development. The collection and analysis of occupational data by industry is a difficult and time-consuming job. Considerably more data than here presented has been collected and considerably more will be collected and analyzed before the research will be completed.

But it is undoubtedly important to let the interested persons know what is being done in this specialized field and what are many of the problems.

14. We humbly feel that this research, when fully completed, will be a significant contribution in assisting nations in their economic planning.

15. In summary, we should point out the basic underlying assumptions of this research project: (1) that planned rapid economic growth for any developing nation involves a rather sharp break with its own historical past; (2) that international comparison of occupational structures is a basic method of making manpower projections; and (3) that the link between manpower planning and the planning of production is the relationship between the skill composition of the labor force in a given industry and the productivity of the industry.

Skills and Productivity

16. The planning of an industrial sector requires considerable understanding of the way in which inputs are transformed to the desired outputs. In economic theory, this transformation is represented by a production function that shows the outputs that can be obtained from various combinations of inputs, assuming a given state of knowledge.

17. Most production functions in economic literature concentrate upon the combinations of capital and labor and hence the substitution of capital for labor and vice versa. Little attention is paid to the type of labor that must be combined with a given type of capital. Production functions deal with relative quantities rather than with qualities of factors.

18. Focusing attention on the type of labor rather than the relative amount of labor is recent phenomena. This reorientation was brought about on the one hand, by the apparent increase in structural unemployment in highly developed economies and the growing awareness of the investment characteristic of education, and on the other hand by the inability of some developing economies to achieve desired levels of productivity with a certain amount of capital because of a lack of skills.

19. Solutions to the two problems of unemployment and low productivity are hampered by the failure of economic theory to formally incorporate labor but as an homogeneous input, and by the paucity of research into the work force composition of different industries and its relationship to productivity.[1/]

20. There is reason to believe that there is a high degree of complementarity between a certain type of production method and the kind of labor force needed for it. In other words, a certain level of technology and hence, a certain level of productivity is represented by a specific kind of organization and a specific kind of capital equipment that is made to work by a labor force whose occupational composition is well defined.

1/ We shall assume that productivity is the relationship of output to a factor of production. Since we are dealing mainly with the input of labor, we shall refer in the future to the productivity of labor simply as productivity.

21. This assumption can be formalized as follows: The productivity of an industry is linked to a specific occupational distribution of its labor force. The production function in this case is of the type

$$Q = F_1 \quad (K, L_1, L_2, \ldots\ldots\ldots L_n) \qquad (1)$$

where L_1, $L_2, \ldots\ldots\ldots L_n$ are the number of workers in occupations 1, 2,.........n, and where K is the amount and type of capital.

22. We can rewrite (1) in the following way:

$$Q/L = F_2 \quad (K/L, L_1/L, L_2/L, \ldots\ldots\ldots L_n/L),$$ where L is the total number of workers.

If we also assume that K/L is a function of the occupational distribution of L, then it follows that:

$$Q/L = F_3 \quad (L_1/L, L_2/L, \ldots\ldots\ldots L_n/L).$$

23. State data of the Unites States were used to test this formulation. Industry occupational data came from the 1960 U.S. Census of Population; industry productivity data, from the 1960 Annual Survey of Manufactures. The former provides the occupational composition of industries in each of the fifty States; the latter, value added and number of employees by industry. We chose State data because of their comparability and the adequacy of the number of observations. Occupations and occupational groups were selected on the basis of distinctive job functions. For example, in the professional and technical category, we separated accountants, engineers, scientists, and technicians. In the manual worker category we separated operatives and craftsmen; and in the craftsmen category, mechanics, electricians, foremen, etc. In all, nineteen occupations or occupational groups were used. The percentage of these nineteen occupations or groups in the workforces of each industry in each state constituted the occupational composition of each industry by state. A multiple correlation across states for each industry between value added per employee and occupational composition gave the following coefficients of determination. 2/

2/ All coefficients of correlation are significant at the 5 per cent level. The coefficients of column (1) were obtained from a linear correlation of the type $y = a + a_1 x_1 + a_2 x_2 + \ldots . a_{19} x_{19}$, where y is value added per employee, x_1 is the percentage of occupation 1 in the total workforce, x_2 the percentage of occupation 2, and so on.

The coefficients of column (2) were obtained from a linear correlation of the type $\log y = a + a_1 \log a_1 + a_2 \log x_2 + \ldots\ldots\ldots + a_{19} \log x_{19}$, where y, x_1, x_2 and so on are the same as in the first equation.

Table I

Correlation Between Productivity and Occupational Distribution in Selected Industries in the United States - 1960

Industry	(1) R^2	(2) R^2
Fabricated Metals	.586	.672
Food and Beverages	.768	.601
Chemicals	.623	.883
Machinery, exc. Electrical	.649	.672
Electrical Machinery	.549	.482
Apparel and other Fabricated Textiles	.614	.688
Printing and Publishing	.569	.617
Textiles	.472	.730
Rubber and Plastics	.458	.651

24. These correlations show a relationship between value added per worker and the occupational mix of a given industry. However, it must be stressed that the nature of the relationship is not the same for each industry. Each industry seems to have its own pattern of occupational change as productivity changes, and we cannot generalize from one industry to another. The following table gives an idea of the direction in which the percentage distribution of selected occupations in the workforce of each industry changes as the industry's productivity varies.

25. This table shows substantial differences among industries. In textiles, for example, operatives trace a clear trend. As productivity increases, the proportion of operators in the total workforce decreases. In contrast, in printing, publishing and allied industries, the number of operatives increases as productivity increases. In fabricated metals, the proportion of managers decreases as productivity increases but in textiles and in apparel, just the opposite occurs. In a number of cases, there is no clear trend between specific occupations and productivity and, in general, there is no indication that an increase in productivity is accompanied by a uniform change in the occupational composition of each industry. This analysis is confined, of course, to a certain minimum productivity range. 3/

26. It is possible that the same relationships between productivity and occupational mix hold for productivities well below (or above) those of United States industries. As will be shown below, we have reason to believe that these

3/ When the difference between the states with the highest and the lowest productivity is small, say 20 to 30 per cent, there is little room to observe marked trends.

Table II

Occupational Pattern vs. Productivity in Selected Industries - United States 1960

INDUSTRIES / OCCUPATIONS	Food and kindred Products	Publishing & Allied Industries	Rubber & Plastics	Chemicals	Machinery except Electrical	Textile Products	Electrical Machinery Equipment	Fabricated Metal Industries	Apparel and Others
Accountants	dotted /	dotted /	dotted /	dotted /	dotted /	solid /	dotted /	dotted /	solid /
Chemists and Physicists	dotted /			dotted /		solid /			
Engineers	solid /			dotted /	solid /	dotted /		dotted /	dotted /
Technicians	solid /	solid /		solid /	dotted /	solid /		dotted \	dotted /
Other Professionals	solid /				solid /	solid /		solid /	solid /
Managers			dotted \		dotted \	solid /	dotted \	solid \	solid /
Clerical Workers	solid /	solid /	dotted \		dotted /	solid /		dotted \	solid /
Sales Workers	solid \	solid \	solid /			solid /	dotted \		solid /
Machinists	dotted /	solid /			solid \		dotted /		
Electricians	solid /	solid /	dotted /		dotted /	solid \			
Mechanics					dotted \		dotted /		
Foremen			solid \	dotted /		dotted /			
Operatives	solid \	solid /				solid \	dotted /		solid \
Laborers			dotted /			dotted \	dotted /	dotted /	

Note: A line from the southwest to northeast corner means that the proportion of this occupation in the total workforce rises as productivity rises: from the northwest to the southeast corner, that the proportion of this occupation in the total workforce falls as productivity rises. A solid line means a strong relationship; a dotted line, a weak relationship; an empty space, no relationship.

relationships do change when considering broad ranges of productivity. 4/ However, the most important lesson to be learned from these data is that there is a systematic relationship between industry occupational mixes and industry productivities, but that each industry has its unique pattern.

Extension of the Argument to International Data

27. The idea that the productivity of an industry is reflected in the occupational composition of its labor force can be applied to international data. The spectrum of productivity levels is much wider, and we can expect clearer trends and more discernible patterns. However, the difficulties involved in using international data are considerably greater than those involved in using United States data. A major difficulty is the lack of comparable systems for classifying and reporting occupations.

Problems of Occupational Classification

28. At a minimum, international occupational data ought to permit interindustry and intercountry comparisons of key occupations, either because they represent skills crucial for development or skills intimately linked to technological change. Occupational data thus have to be in sufficient detail to show well defined jobs which can then be combined into groups of closely related jobs on the same level of skill and requiring the same types and amounts of education and training. Furthermore, for purposes of international comparison, job groupings of different countries ought to include the same types of work. However, such comparability is more than a matter of job title; it also involves job content.

29. Population censuses are the source of most of the currently available occupational data. To varying degrees, all census data seems more concerned with reporting traditional job titles, regardless of their significance to the economy, than with reporting jobs, especially new ones, essential for growth, or with determining whether the title fits the content of the job. For example, at least one major European country seems more interested in knowing how many barkeeps it has than in knowing how many technicians of various types it has. Different types of technicians are grouped under one all inclusive label, irrespective of what they actually do, etc.

30. For the researcher, international occupational data, even when it does exist, presents three interrelated problems, aside from the question of accuracy, which we assume solved for this discussion. The first problem, and conceptually the least serious of the three, is excessive aggregation, compounded by a failure to use similar groupings of data. Dissimilar groupings reflect in part differences in the degree in aggregation; in part, different combinations of occupations at

4/ One difficulty with using State data, in contrast to using international data, is that the occupational structure of an industry in a given state may come from establishments that specialize in the production of a few items. The product mixes of industry in each of several industrially diversified countries probably are more alike than they are in each of several states in the United States. Specialization in the products of a given industry is apt to be sharper among states than among nations.

the same level of aggregation. No country presents data in as great detail as that provided by the five-digit occupational titles of the International Standard Classification of Occupations (I.S.C.O.). 5/ Most countries use either the three-digit unit groups of I.S.C.O., its two-digit minor groups, or some variation of one or the other. An example of a five-digit I.S.C.O. occupation would be "Machine-Tool Setter, Metal Working", part of the three-digit unit group, "Fitter-Machinists, Toolmakers and Machine-Tool Setters", which in turn is part of the two-digit minor group, "Toolmakers, Machinists, Plumbers, Welders, Platers and Related Workers". 6/

31. Any aggregation above the three-digit level is relatively useless if one is interested in precise occupational comparisons. Unfortunately, once the data has been combined in dissimilar ways, it is impossible to make valid international comparisons unless one can decompose the figures, a procedure precluded by the failure to publicize occupational data in finer detail.

32. Aggregation presents another problem as well. It conceals what might be vital jobs in an occupational structure or significant trends by submerging them in a broad grouping. Broad groupings are particularly deceptive if they contain offsetting trends. Our own work with United States occupational data by industries and states suggests, for example, that certain specific occupations, such as accountancy or mechanical engineering, might be more important in distinguishing different sectors of an industry, than a more inclusive group, such as one containing all professionals. Moreover, it makes a great deal of difference for educational planning whether it is necessary to provide physical plant and faculties to educate accountants or whether it is necessary to provide physical plant and faculties to educate engineers, and within the latter group, whether to educate electrical engineers or industrial engineers. The more advanced the occupational level, the greater the likelihood of specialization and the greater the difficulty of moving to another professional specialty even within the same profession.

33. The second and by far the more serious problem, is the proclivity for classifying occupations by product or by process rather than by level of skill or by degree of work complexity. In part, but only in part, this preference reflects the use of socio-economic categories rather than those based on technological considerations. But it also reflects the absence of a universal system for determining the complexity or skill of a job. I.S.C.O., for example, often groups together blue-collar workers engaged in the same activity or industry, irrespective of skill level. This problem is prevalent on the three-digit level, but even the five-digit level of reporting is not immune. For example, I.S.C.O. has a five-digit occupation "Electrical Fitter (Domestic Appliances)," who:

5/ International Labour Office, International Standard Classification of Occupations (Geneva, 1958).

6/ Ibid., p. 113 to 114.

> Fits, assembles and repairs electrical domestic appliances in factory: performs basic tasks similar to those of Electrical Fitter, General . . . but works on electrical domestic appliances, such as electric fans, vacuum cleaners and irons, of which special knowledge is required. 7/

Is this an all around craftsmen, a skilled fitter-assembler or merely a semi-skilled assembler? The implication is that he does all the tasks specified, but the likelihood is that he specializes in just one or two at most. Such a definition, in short, gives the coder too much discretion, particularly since I.S.C.O. does not provide an alternative classification for placing workers doing just one specialized job in the assembly of domestic appliances.

34. The merging together of different skill levels makes it almost impossible to isolate occupations that probably are crucial for economic development. Skilled manual workers and first line supervisors too easily disappear in an abyss entitled, variously, "craftsmen and production workers" or when the classification is based upon industry rather than socio-economic level, as in the case, for example, of "chemical and related process workers". It would seem essential to separate skilled production workers from semiskilled machine tenders or process workers. Similarly, unskilled workers or learners ought not be included with skilled and semiskilled workers. Typically only unskilled laborers appear by themselves, even though lack of skill is not only or even primarily a matter of whether or not the work requires brawn rather than brains.

35. The neglect of skill differences is not restricted to blue-collar workers. It is almost endemic among white-collar and service worker categories, which bear the burden of somewhat archaic social distinctions rather than more useful functional distinctions. All censuses as well as I.S.C.O., treat managerial and administrative personnel alike, as if the corporation president, the plant manager and the department foreman performed work at the same level of difficulty and required the same amount of training and experience. In some censuses, the working proprietor is segregated, but this is a relatively rare concession. According to most classification systems, managers are egalitarians at heart.

36. Luckily, a somewhat better job of distinguishing skill levels occurs in the classification of clerical and sales workers because many job titles coincide with differences in the degree of work complexity or the amount of skill required. But even in this case there are disturbing lapses. Very often there is one all inclusive category for office machine operators or for all sorts of specialized clerks. Unfortunately, machine operators and specialized clerks include a fairly broad range of skill levels, the majority of a nation's clerical workers, and, frequently, rapidly growing occupations. Sales clerks who may not be much more than package wrappers and money collectors are indiscriminately dumped with sales people who have to persuade customers to buy

7/ Ibid., p. 126.

expensive consumer durables. There may be good reasons for combining such disparate occupations, but one of the reasons certainly is not to rank jobs by skill level.

37. Finally no census tries to differentiate service jobs by degree of complexity, except in a very rough, accidental fashion. Thus service workers often are classified into those working in households and those working outside. The inference is that the former are at the bottom of the skill scale. I.S.C.O. has a fairly elaborate classification of service workers, but it is necessary to get to the five-digit level before skill differences can be distinguished. Even here, however, there are difficulties. First, skill differentiations are largely fortuitous, the result of conventional ways of labelling and grouping jobs rather than any systematic effort to rank them by complexity. This neglect is not unique to I.S.C.O. No census tries to do this. Secondly, even the rough skill differentiations discernible at the five-digit level have ambiguities. Again this feature is not unique to I.S.C.O.

38. A few examples are in order. How does a cook compare in terms of skill with a policeman, or a beautician with an airline stewardess? The difficulty is compounded when one tries to make comparisons among major groups. Is a keypunch operator or a telephone operator the equivalent of a stewardess? And how do all three compare with a rolling mill operator or a carpenter? There are no guidelines here. It is assumed, more or less, that the clerical worker and the service worker, excepting drudges, need more formal schooling than the blue-collar worker, and that therefore the former is "above" the latter in some way. In terms of experience and training, however, the rolling mill operator and carpenter probably are the "superior" of the average clerk or service worker.

39. Actually we have just stumbled upon our last problem. Census occupational data are gathered without trying to learn anything about the content of the jobs reported. Only job content can offer clues about the degree of complexity of the work and the degree of skill needed to perform it. For example, what is a cook? Is he a chief or an exalted counter clerk? What is a machinist? An all around craftsman, job setter or the operator of a specialized machine tool, possibly completely automatic. Questions of content are especially important when comparing the occupational structures of industries at different levels of mechanization. Job titles by themselves can confuse the difference between modern machine skills and traditional artesan skills. The more technically advanced an enterprise or industry, the greater the likelihood of specialization and the greater the likelihood that the work will not require traditional skills, even though the traditional titles continue to be used. Thus a low productivity textile industry might have a high proportion of skilled weavers, while a high productivity textile industry might have comparatively fewer weavers, most of whom actually are semiskilled machine tenders. One could multiply such examples, not only with respect to manual worker jobs but also with respect to white-collar and service ones as well, as our earlier discussion suggests.

40. The occupational code we developed for our work 8/ reflects many of the dilemmas noted above. We chose I.S.C.O. as our frame of reference on the grounds

8/ Bureau of Business and Economic Research, Northeastern University, "Classification of Occupations by Skill Level", 1964, unpublished multilith.

that other nations were also likely to use it, or a modified version of it, than they were to use the census categories of the United States. We first tried to rearrange I.S.C.O.'s five-digit occupations according to broad skill categories, such as skilled, semiskilled and unskilled for manual worker occupations, and higher-skilled and lesser-skilled for white-collar workers and service workers. However, the failure of I.S.C.O. to delineate blue-collar skill levels or to separately account for supervisors, and the failure of most census data to do the same or to report occupational data in sufficient detail, forced us to abandon our original effort. We now have adopted a classification system based upon occupational titles as reported by individual censuses rather than one based upon skill requirements. It was difficult to find data that did not mix in various ways blue-collar jobs of different degrees of complexity. We made no effort to rank managerial positions by skill, because rarely are they reported in sufficient detail, nor is there a ranking system available, for the purpose.

41. Our original classification scheme also sought to distinguish between blue-collar and service occupations that cut across industry lines (e.g., tire builder, weaver). The objective was to minimize the number of classifications as well as to identify occupations that might affect multiple industries, perhaps the entire economy. Our revised classification retains this distinction to the extent that existing census classifications do. Here again, however, job titles or names rather than skill level or work content, are the basis for classifying and reporting data.

42. Some fundamental problems remain, however. One is the failure (perhaps inability) of census takers to obtain meaningful information about work content. Another is the absence of a method for ranking jobs by skill level or work complexity. The Bureau of Employment Security of the U.S. Department of Labor has developed such a ranking system as a means of revising its <u>Dictionary of Occupational Titles</u>. The ranking method depends upon careful analysis of work content and worker functions, and insofar as the complexity of the work is concerned, does not permit comparisons among different occupational families. For example, one cannot compare the relative complexity of a truck driver's job with that of a coal miner. Moreover, the U.S. Bureau of the Census does not use it for its own occupational classification.

43. Perhaps censuses of population should not be used to obtain extensive or detailed occupational information. Instead such data might better be obtained from special establishment surveys similar to or part of regular surveys or censuses of manufacturing and of industry. There probably is no other way of discovering what workers actually do, and it is this knowledge that underlies any systematic ranking of occupations by skill. There are further advantages of such a special survey or census. The occupational data would be grouped automatically by industry and, if one wanted, by establishment size as well. Moreover, the occupational data would come from the same universe and over the same time periods as the production data. Efforts to relate occupational structures and employment to productivity in an industry would be helped considerably by such a simple matter as ensuring that all the data referred to the same sector and date.

<u>Problems of Comparing Productivities</u>

44. A second difficulty arises in comparing productivities. This problem has

occupied a prominent place in economics, and despite numerous attempts to solve it, progress has been slow, and practical measures of comparison few. Differences in exchange rates, taxation policies and subsidies, wages, product mix, markets, depreciation policies, etc. make the task of comparing productivities of industries in different countries almost insurmountable. There is, however, an inverse relationship between the difficulty of comparing productivities and relative differences in "real productivity". In other words, when industries of different countries use similar technologies it is much more difficult to rank productivities than when industries use very different technologies, such as a highly advanced technology compared with a simpler one. The wide range of industrial productivities in an international sphere makes it easier to rank industries. Moreover, ranks can be based upon more than one criterion, each of which can serve as a check on the other. Value added per employee in local currency multiplied by a common exchange rate, power consumed per worker measured in metric tons of coal equivalent, and electricity consumed per worker measured in KWH are some of the alternatives. On the other hand, a disadvantage in making international productivities comparisons is the small number of observations, especially at the lower end of the productivity scale as it is hard to generalize on the basis of a limited number of observations. Nevertheless we shall try to draw some conclusions with respect to the relationship between occupational compositions and productivity in manufacturing industries in different countries. 9/

International Comparisons

45. The data we have chosen to present came from Canada (1951), United Kingdom (1951), United States (1950 and 1960), Japan (1960), Turkey (1960), India (1956). We also have included Puerto Rican data for 1960. The productivity ranks and the occupational compositions of the different industries on each of these countries and in Puerto Rico are given in appendix II.

46. Four major occupational groups were used to illustrate our point that there is a relationship between productivity and occupational structure. The number of occupations and countries, of course, is too small to be more than indicative. Conclusive evidence will have to wait until we have completed our collecting of international data.

47. The occupational data are not as refined nor as detailed as we would have liked. For the reasons mentioned in the section dealing with occupational classifications, it was impossible to group the occupational data of all the countries on the basis of skill levels, with the exception of completely unskilled work. Most blue-collar occupations reported by Puerto Rico, India, and Japan are mixtures of skills, combinations of skilled and semi-skilled.

9/ We currently are engaged in research sponsored by the Agency for International Development for the purpose of gathering information about the occupational distribution of industries on a worldwide scale. The final product of this research will be a collection of tables showing a detailed occupational distribution for about sixty sectors - in some sixteen countries. The number of countries was determined by the availability of data. The occupational distributions will include about two hundred occupations.

The alternative to using a very detailed (e.g., 3-digit) classification that did not necessarily reflect skill levels (nor necessarily include all countries) was to lump blue-collar occupations in a single category. The same admixture of skills exists in the other major occupational groups, save for professional and technical. Furthermore, detailed data (e.g., a three-digit classification) are not available from some countries or only on an incomplete basis. In the case of Turkey, for example, the available data give only a total figure for managerial and clerical occupations combined and only a total for professional and technical combined. Finally, in the case of India the reported figures of professional and technical workers seem to include skilled craftsmen and supervisors, thus inflating the proportion of high level occupations in industrial workforces. Despite these shortcomings, general tendencies can be seen between these occupational groupings' and productivity.

48. In all industries, except printing, publishing and allied products, there is a direct relationship between professional and technical workers and productivity. As productivity rises, so does the proportion of professional and technical. The proportion of professionals taken alone behaves in a similar way although somewhat less consistently. For example, in textiles there is no obvious relationship between professionals and productivity. The proportion of technicians, however, shows a less consistent behavior than that of professionals. Almost every industry in the United Kingdom shows a higher proportion of technicians than one would expect if there were a consistent trend for this occupational group. Perhaps technicians in Britain do many jobs done by professionals elsewhere, or conversely many professionals in the United States and Canada do work that technicians could do. In any event, it seems that in general as productivity rises, so does the proportion of technicians.

49. On the other hand, the proportion of white-collar workers in many industries seem to trace no pattern as productivity changes. A pattern does seem to emerge in textiles, fabricated metals, machinery, and rubber products. However, it is a slight one and appears only if we exclude Japan. Japan seems to be a special case. The proportion of white-collar workers is unusually high in many industries on the basis of their productivity ranks. This peculiarity may reflect traditional employment practices or special social conditions.

50. Within the white-collar group, managers, officials and proprietors (which exclude foremen), also show no relationship to productivity. It seems that assertions that the proportion of managers must increase for productivity to increase are unfounded, once some minimum proportion is attained. State data for the United States corroborate these findings for the international sphere. Of course, we cannot conclude that there is no connection between the quality of management and productivity. Further, the broad nature of the managerial classification we have used may conceal a distinctive trend for a specific type of manager, such as plant managers or company executives responsible for planning, but the data available to us at the present time do not reveal any obvious relationships.

51. The same conclusion applies to the clerical and sales groups. Their proportions also show little or no systematic change with productivity. Still, certain types of industries appear to have a unique proportion of white-collar workers different from that of other types of industries. For example, petroleum and coal products, printing and publishing, and chemicals, have on the average

higher proportions of white-collar workers than apparel and other finished textiles, textiles or fabricated metals.

52. Service workers as a group, although insignificant in terms of their proportion of the total work force, in any industry, present a distinct pattern if we group the countries in our table on the basis of whether they have predominantly low or high productivity industries. Industries in countries with predominantly low-productivity industries in general have a high proportion of service workers compared with the industries in high productivity countries. The intra group relationships are extremely weak. Our finding corresponds with observed patterns in less developed countries, where one usually is surprised, when visiting local plants or administrative offices, to find so many functionaries engaged in service activities, primarily unskilled in nature. This apparent prolificacy may be the consequence of low wages, as well as of entrenched traditions and social mores.

53. The proportion of blue-collar workers in the labor force generally is inversely related to productivity. This trend is even stronger for the unskilled. Again, we must emphasize that other and more clearcut patterns probably are hidden within the all inclusive skilled and semiskilled group, which inadvertantly even includes working foremen and supervisors. These internal shifts disappear with aggregation. Only a very disaggregated occupational classification system can provide the practical tool needed for discerning those occupational patterns related to productivity that are useful for manpower planning.

Education and Manpower Needs

54. Our assertion that an industry's productivity depends on the composition of its labor force and that a detailed classification of occupations is needed for efficient manpower planning conflicts to a certain extent with the position of those who hold that the educational level of a nation's population is a major determinant of productivity. It is not the educational level, but the skills of a nation's workforce that seem to count most, and the two are not necessarily synonymous. 10/

55. A traditional index of the qualifications needed for an occupation is the educational level of its practitioners, but this is by no means the only standard

---

10/ It will be helpful to keep in mind that when we refer to occupations we have in mind functions. We are not evaluating the general capacity or the alternative abilities of the individual who happens to be performing a particular function. In other words, when we say that industry A requires a certain percentage of electricians to achieve a specified level of productivity, we assume that workers assigned the tasks and duties associated with the job description of electrician are in fact reasonably competent electricians. In effect, we classify a worker according to his duties, as reported by him, and not according to anything else he can do. If a lawyer, for example, is working as a foreman, we consider him a foreman and not a lawyer.

by which to judge occupational requirements. Economists and educators, especially the latter, tend to stress formal education and not other quite important ways by which people acquire skills. 11/

56. A greal deal of attention has been paid and continues to be paid to the education of professional and technical workers. One possible reason is that the gestation period of these occupations is long (an engineer's education, for example, takes at least another nine to ten years after finishing elementary school) but the way to become a professional is generally fairly well defined and singular. The less conspicuous but yet important skilled manual workers until recently have drawn much less attention from educators and economists despite their numbers and their role in production. It therefore is not surprising that there is little knowledge about the level of education or the amount of training needed by those in skilled blue-collar jobs or in semi-skilled ones. Although the way to become a skilled worker is not clearly delineated, training a craftsman may require years of formal schooling and then additional years of on-the-job training and work experience. To complicate matters, training may be substituted for schooling and vice versa, and skills appropriate to one occupation may be transferable in varying degrees to other occupations. Thus there are multiple paths of skill acquisition all leading to the same objective - the turning out of a person who can meet the work requirements of an occupation.

57. Statements to the effect that formal education automatically yields a higher level of productivity, while not particularly useful for practical manpower planning, may even be harmful to countries that lack the resources to formally educate large masses of people destined to become blue-collar workers. The fact that there are countries with both high average levels of education and high levels of industrial productivity may reflect more than an occupational structure heavily weighted with occupations that require extensive knowledge and broad abilities obtainable only after years of formal schooling. The high average levels of education also may reflect an overall high level of general education made possible by high per capita real incomes. This amount of education may be more than what is needed solely to accomplish the work of the economy.

58. The view that educational levels in some industrially advanced countries exceed occupational needs seems to be supported by international comparisons of the years of schooling of workers in given lines of work. The table in Appendix III compares a few specific occupations taken from clerical, service, and skilled worker categories in the United States, Canada, Japan and Great Britain. The years of schooling are approximations, because each country either

---

11/ There probably are many reasons for this predilection. First, there is little concrete information about how people actually acquire specific skills of a nonprofessional sort. Second, it may be worthwhile noting that economists and educators, being themselves professionals whose vocational preparation has been almost exclusively formal in nature and has rested upon an earlier period of unspecialized general education, tend apparently to generalize their own experiences and their knowledge of other professions to encompass all type of jobs.

collects somewhat different information or groups it differently. For example, Canadian years of schooling are arranged in the following categories: 0-4, 5-8, 9-12, and 13 years or more. United States years of schooling are not presented in exactly the same way: 0-4, 5-7, 8, 9-11, 12, 13-15, 16, and 17 years or more. On the other hand, the British do not give years of schooling but the age at which formal education is completed. Age of completion distributions then must be translated as best as possible into corresponding years of schooling.12/ However, we could not take into consideration differences in quality of education. Further, the broad years-of-schooling distributions obscure the number of persons who failed to complete elementary or secondary school. Nevertheless, if we assume that workers in the same occupations in different countries have even approximately the same capabilities, then the differences in years of schooling for the same occupations in different countries are so great that we cannot help but conclude, that educational levels in high productivity countries are the result in part of a demand for education that is like that for an income elastic consumer good. Technology alone cannot be the sole explanation.

59. In planning for the training of skills the important consideration may be the minimum level of education needed before a person can learn to perform effectively the duties of an occupation and the different rates of substitution between formal education and other forms of training. Developing nations, with limited resources, have to be especially careful to choose the most efficient and economical ways to impart scarce skills and not become swayed by the example of the more prosperous nations where the blue-collar worker probably is overeducated from the limited standpoint of production requirements.

The Use of Input Output Techniques in Planning Manpower Requirements for Development

60. Our assumption of a unique link between the level of productivity in an industry and the occupational distribution of its labor force allows the incorporation of occupational data into general input-output models.

61. Input-output tables generally assume: (a) fixed capital-labor coefficients, (b) fixed interindustry coefficients, (c) a unique technology for every sector, (d) homogeneous labor.

62. Our model assumes, as in the general model, that (1) interindustry coefficients are constant, but unlike the general model that (2) the productivity of an industry is a function of its occupational composition, (3) the amount of capital employed is a function of the occupational composition, (4) there are many technologies and hence productivities, available to each sector and, (5) the occupational composition of the population as a whole is known.

12/ This type of translation can be no more than an approximation, as it was in the case of the British data, despite use of the excellent descriptions of educational structures in UNESCO'S World Survey of Education - II (Paris, 1958).

63. If we assume a country with three sectors and three types of skills (this example can be expanded easily to n sectors and m skills) we may write:

$$X_1 = a_{11}X_1 + a_{12}X_2 + a_{13}X_3 + X_{1D} = a_{11}X_1 + a_{21}X_1 + a_{31}X_1 + rK_1 + S_{11}w_1 + S_{21}w_2 + S_{31}w_3 \qquad (1)$$

Where X_1 is the production of industry 1

X_{1D} is the final demand for the product of industry 1

S_{11} is the number of people in occupation 1 employed in industry 1

r is the rate of return per unit of capital

K_1 is the amount of capital in industry 1

w_1 is the wage paid for skill 1

a_{12} is the interindustry coefficient

Regrouping (1) we have

$$X_1(a_{21}+a_{31}) = a_{12}X_2 + a_{13}X_3 + X_{1D} - rK_1 - (S_{11}w_1 + S_{21}w_2 + S_{31}w_3) \qquad (2)$$

dividing and multiplying certain terms by L_1, the number of people employed in industry 1, we have

$$\frac{X_1}{L_1}(a_{21}+a_{31})L_1 = a_{12}X_2 + a_{13}X_3 + X_{1D} - rK_1 - L_1\left(\frac{S_{11}}{L_1}w_1 + \frac{S_{21}w_2}{L_1} + \frac{S_{31}w_3}{L_1}\right) \qquad (3)$$

where $X_1/L_1 = P_1$ is the productivity of labor in industry 1, and $s_{21} = S_{21}/L_1$ = percent of occupation 2 in the labor force of industry 1; we now can write the whole system as follows:

$$P_1(a_{21}+a_{31})L_1 - a_{12}X_2 - a_{13}X_3 + rK_1 + L_1(s_{11}w_1 + s_{21}w_2 + s_{31}w_3) = X_{1D}$$

$$\left[P_1(a_{21}+a_{31}) + s_{11}w_1 + s_{21}w_2 + s_{31}w_3\right] L_1 - a_{12}X_2 - a_{13}X_3 + rK_1 = X_{1D} \qquad (4)$$

$$\left[P_2(a_{12}+a_{32}) + s_{12}w_1 + s_{22}w_2 + s_{32}w_3\right] L_2 - a_{21}X_1 - a_{23}X_3 + rK_2 = X_{2D}$$

$$\left[P_3(a_{13}+a_{23}) + s_{13}w_1 + s_{23}w_2 + s_{33}w_3\right] L_3 - a_{31}X_1 - a_{32}X_2 + rK_3 = X_{3D}$$

Also

$$L_1 s_{11} + L_2 s_{12} + L_3 s_{13} \leq \bar{S}_1$$

$$L_1 s_{21} + L_2 s_{22} + L_3 s_{33} \leq \bar{S}_2$$

$$L_1 s_{31} + L_2 s_{32} + L_3 s_{33} \leq \bar{S}_3$$

where $\bar{S}_1$, $\bar{S}_2$, $\bar{S}_3$ are number of available people with occupations 1, 2, 3.

Assumptions 2 and 3 stated above, can now be introduced, namely,

P_1 is a function of the occupational composition of industry 1

K_1 is a function of the occupational composition of industry 1.

We also assume that X_{1D} is a function of X_1 or a given parameter, and occupational wage rates and interindustry coefficients are given.

64. We therefore have n industry equations and m occupational equations, and total number of equations is $n + m$, and the total number of unknown is 2n (n L's and n X's) if m, the number of occupations, is less than n, number of industries, we can introduce $n - m$ constraints. One of these constraints could be the maximization of $X_1 + X_2 + X_3 =$ total production.

65. What is the advantage of this model over the general input-output model? The input-output model implicitly assumes that the economy possesses or has the ability to generate the skills needed for the implementation of the desired outputs (i.e., the development plan). If the skills needed for the plan are not forthcoming, not only is one industry affected, but the entire plan suffers. For example, if the chemical industry has a specific target for employment and production, and there is a shortage of trained personnel, like electricians, productivity may drop and the production fall short of the mark. This lost output in turn may affect production in industries supplied by the chemical industry.

66. The assumption of a fixed productivity per sector also hinders maximization of output criteria, because the production boundary is determined by the productivity assumed. Assuming that a range of productivity is available per sector to some extent removes the restriction imposed by a single choice of productivity. There thus is a greater likelihood of maximizing total output.

67. More important, with the introduction of the manpower variable, we can avoid the pitfall of developing a plan that may be doomed to failure from the outset because of the lack of qualified manpower. The introduction of boundaries imposed by the availability of occupational skills makes possible a feasible solution for the plan or the I-O model. Moreover, each industry can have a variety of productivities and hence occupational distributions, and capital requirements. We may choose for example, to have high productivity in metals and low productivity in textiles or high productivity in chemicals and a low productivity in food and beverages. The choice of productivity will be governed in part by the allocation of scarce skills. This point can be illustrated by the following example. Assume a country with two industries, A and B, and with a scarcity of mechanical engineers relative to technicians. Now suppose that an increase in productivity in industry A depends to a large degree upon increasing the proportion of mechanical engineers in its workforce and decreasing that of technicians. In other words, if we reduce the proportion of engineers and increase that of technicians, productivity in this industry will fall significantly. In contrast, suppose that in industry B, an increase of productivity depends more upon a higher proportion of technicians than upon a higher proportion of engineers. Here a reduction in the relative numbers of engineers will not reduce productivity very much. In this highly simplified case, it may pay to shift mechanical engineers from B to A. The combined productivity of A and B may rise as a result.

68. In other cases, productivity in an industry, say X, is unaffected by moderate changes in the proportion of a given occupation in the workforce, but still requires a minimum proportion for effective functioning, as seems to be true for managers in a number of industries. At the same time productivity in another industry, say Z, may depend upon the proportion of its employees in this particular occupation. If there are a limited number of people with the skills required by this occupation, and if they already are employed at this work, total production may be increased by shifting such workers from X to Z, provided their

-nal

proportion in X's workforce does not fall below the minimum level. In this instance, it may not be advisable to try to increase productivity of industry 2 until the supply of the requisite skill has increased. The outcome will depend upon the productivity gain desired in industry 2 and hence upon the number of workers with the necessary skills that industry X must give up. Extension of this reasoning to incorporate a large number of industries requires a general model that takes account of all their particular manpower requirements.

Industry Versus Plant Data

69. In practice an input-output model that incorporates manpower requires knowledge of the occupational mixes and corresponding productivities of different industries. The usefulness of such occupational matrices has been challenged on the grounds that the occupational composition of an industry comes from a mixture of technologies and products and therefore cannot actually be used to determine the composition of the labor force of a plant or a limited number of plants. This argument is valid at one level of decision-making but not at another.

70. Unquestionably, if we want to build a single plant and if we know precisely the products that will be produced and the tecnology that will be used, the best way to determine the staffing pattern is to inspect engineering data in the hands of equipment producers or engineering consultants. However, a general development plan deals for the most part with unknown or only partially known product mixes of a number of different industries. It also deals with varying technological stages in each industry, because an industry will not only contain plants with identical ages or with identical technologies. Further, the plan will have to take account somehow of future changes in these technologies.

71. It cannot be assumed that an industry in the future, will duplicate the types of techniques and the mix of products and all in the same proportions, as the plants furnishing the data used to prepare the plan. Nor can it be assumed that the exact future composition of the industry will be known in advance.

72. Further, new plants alone cannot tell us the future composition of an industry. Industry expansion is the net result of additions of new plants (or operations) at one end of the technological spectrum, scrapping of old plants at the other end, and the replacement of those in between. The net change in occupational structure thus reflects the difference between the added plants (or processes) and the scrapped plants (or processes). Simply looking at the potential additions ignores the scrapped plants and the replacement needs of continuing operations.

73. Reliance upon plant data is especially unwarranted in the case of plans whose purpose is the provision of general policy recommendations rather than concrete projects and detailed direction. If a nation's policy is the encouragement of industrial expansion in a free market environment, industrial managers will have to be allowed to determine the proper mix of products and techniques within the framework of the market or of otherwise established incentives. Decentralized decisions with respect to products and techniques cannot be predicted accurately. Use of industry data from different countries in effect assumes that these decisions already have been made. In a free market, then, unless we know the number and nature of the products of all future plants in an industry, the use of data from existing plants, whether in the same or in other

countries, will yield large errors. Plant data is valuable only if the precise plant and product composition of the future industry is known. In short, the degree of disaggregation in the data cannot be finer than the level of decision-making. Industry data offer a better chance than plant data of yielding offsetting rather than reinforcing errors. Use of industrial occupational structures to forecast occupational needs of an economy contains the possibility of two types of errors -- an error in occupational mix and an error in the importance of a specific industry in the total economy. Unless all (or most) industry forecasts are biased in one direction, errors in industry forecasts are likely to cancel out and thus help prevent incorrect occupational forecasts for the overall economy. Similarly, errors in forecasting occupational mixes are likely to produce the same cancelling effects.

A Feasibility Test

74. The planning procedure of most development plans is to project production targets first and only then to refer the results to a manpower expert for forecasts of the labor that will be needed. The usual purpose of the manpower projection is to enable the authorities to plan the educational facilities that will be required to furnish the necessary skills. Sometimes plans are implemented even when manpower projections are not available, but the chances of success are reduced considerably as a result. Such planning procedure can be costly and disappointing.

75. However, the manpower planner can help avoid such failures by playing a much more fundamental role than simply one of helping to implement part of an already conceived plan. He can check the feasibility of a plan by determining whether the requisite occupational skills are or will be available to complement the proposed investments. Moreover, he can indicate alternative ways of using available manpower and can formulate policies to prevent potential imbalances in the future demand and supply of skills. Tables of industrial occupational structures and their corresponding productivities thus provide the manpower planner and, of course, the general planner with an ideal tool for testing the practicality of a development plan.

76. This manpower feasibility test can be expressed in the following way: If productivity of industry j is a function of x_{ij} then

$$\sum_{j=1}^{n} x_{ij}L_j \leq \bar{X}_i$$ where $\bar{X}_i$ is the available supply of occupation i, x_{ij} is the proportion of people with occupation i in the work force of industry j, and L_j is total employment in industry j.

Maximizing Employment and Allocating Labor

77. There are other important uses of such tables. They can help allocate investment from the point of view of maximizing employment. A rapid increase in productivity in one industry, may displace a large amount of unskilled labor and at the same time put pressure on some scarce occupation. When the two types of labor are not substitutes for each other, one way to provide employment for the displaced is to expand industries that use them in relatively large numbers.

Another way is to increase the supply of the scarce skill. Tables linking changes in the occupational mixes and in the productivities of different industries may suggest which industries should be encouraged in order to absorb workers of a given type. Such tables also can suggest which industries should be discouraged from adopting new techniques if the only way to staff them is by pirating irreplaceable key workers from other equally essential industries.

Improving Manpower Forecasts

78. Occupational compositions of different industries offer fairly good clues about the importance of different occupations in different industries and serve to identify occupations unique to one industry (or a few industries) and cross-industry occupations, that is, ones that are used in many industries. A worker with a skill specific to one industry (like that of a tire vulcanizer) may find it difficult to make interindustry transfers without special retraining. Errors in forecasting the number of people in a cross-industry occupation (such as electricians) in one industry may be compensated by an error in the opposite direction in another industry. On the other hand, errors in forecasting the demand for jobs specific to an industry can be more serious because of the unlikelihood of similar offsets. Forecasts of occupations specific to an industry thus must be more accurate than forecasts of cross industry occupations. Industrial occupational structures offer a way of ensuring greater accuracy where needed.

Verifying Productivity

79. Another use of the tables is to help rank the productivity of an industry in one country or region when the figure is uncertain. If an occupational structure varies consistently with productivity, it is possible to place a geographical sector of the industry between two other geographical sectors of the industry whose productivities are known, by comparing occupational structures. In any case, occupational structures should and can be a complementary way of verifying international comparisons of industrial productivity.

Training Workers

80. These tables, together with information about the different ways skills are acquired (paths of skill acquisition), can do more than provide a basis for planning educational facilities. They can also help make best use of existing and planned facilities for on-the-job training, an important source of skills that has received little attention until recently.

81. To summarize, industry occupational tables are a means of making more realistic manpower projections and serve such subsidiary functions as verifying dubious productivity data, improving the short run allocation of labor, avoiding chronic unemployment, and improving in the use of in plant training facilities.

Appendix I

OCCUPATIONAL GROUPS USED IN THE MULTIPLE CORRELATION OF UNITED STATES STATE DATA

1. Accountants and Auditors
2. Chemists and Natural Scientists
3. Engineers and Architects
4. Technicians
5. Other Professionals
6. Managers, Officials, Proprietors
7. Clerical and Kindred Workers
8. Sales Workers
9. Blacksmiths, Boiler Makers, Millwrights, Tinsmiths
10. Machinists
11. Electricians
12. Plumbers
13. Mechanics and Repairmen
14. Foremen, N.E.C.
15. Cabinet Makers and Carpenters
16. Craftsmen, N.E.C.
17. Tool-die Makers
18. Operatives
19. Laborers

Appendix II

PERCENTAGE COMPOSITION [a] OF THE LABOR FORCE IN MANUFACTURING INDUSTRIES FOR SELECTED COUNTRIES AND YEARS [b]

a/ Figures do not necessarily total 100 per cent because of rounding and omission of unspecified occupations or in a few cases of unreported ones.

b/ See Page 44 for sources.

INDUSTRY: TEXTILE MILL PRODUCTS - ISIC No. 23

	U.S. 1960	Canada 1950	U.S. 1950	U.K. 1950	Puerto Rico 1960	Japan 1960	Turkey 1960	India 1956
Prof. & Tech.	1.7	1.8	1.4	1.1	1.4	0.4	0.7	1.1
Professional	1.1	1.0	1.0	0.5	1.1			
Technical	0.6	0.3	0.4	0.6	0.3			
White Collar	11.2	13.4	9.3	8.6	6.1	11.2	4.1	3.7
Mgr., Off. & Prop.	2.3	3.4	2.4	2.7	1.8	3.5		0.6
							3.7	
Clerical	7.2	8.8	6.0	5.3	3.2	6.2		3.1
Sales	1.2	1.2	0.9	0.6	1.1	1.5	0.4	
Service Workers	0.1	0.6	0.1	0.1		1.5	1.3	0.8
Blue Collar	84.2	83.6	88.0	90.1	92.6	87.1	93.9	94.4
Skilled & Semi-skilled	76.7	69.0	80.6	73.7				57.9
Unskilled	7.5	14.6	7.4	16.4				36.5
TOTAL	97.2	99.4	98.8	99.9	100.0	100.0	100.0	100.0

INDUSTRY: FOOD AND BEVERAGES - ISIC Nos. 20 and 21

	U.S. 1960	Canada 1950	U.S. 1950	U.K. 1950	Puerto Rico 1960	Japan 1960	Turkey 1960	India 1956
Prof. & Tech.	2.1	2.3	2.5	1.5	1.1	0.7	1.1	1.9
Professional	1.5	1.7	1.9	1.0	1.0			
Technical	.6	.6	.6	.5	.1			
White Collar	34.0	24.0	27.1	20.3	22.5	24.8	12.6	
Mgr., Off. & Prop.	7.4	6.9	7.5	5.0	6.7	5.3	9.9	1.4
Clerical	10.0	12.0	10.8	10.8	5.6	9.0		
Sales	16.6	5.1	8.8	4.5	10.2	10.5	2.7	
Service Workers	0.4	1.0	0.3	0.1		1.3	3.2	2.5
Blue Collar	61.0	72.7	69.2	77.8	73.6	70.5	83.1	88.0
Skilled & Semi-skilled	44.9	49.1	56.4	44.2				16.7
Unskilled	16.1	23.6	12.8	33.6				71.3
TOTAL	97.5	100.0	99.1	99.7	97.2	97.3	100.0	93.8

INDUSTRY: CHEMICALS AND CHEMICAL PRODUCTS - ISIC No. 31

	U.S. 1960	Canada 1950	U.S. 1950	U.K. 1950	Puerto Rico 1960	Japan 1960	India 1956
<u>Prof. & Tech.</u>	15.4	9.3	11.7	8.8	6.2	3.7	4.8
Professional	10.4	5.8	9.1	4.5	5.1		
Technical	5.0	3.5	2.6	4.3	1.1		
<u>White Collar</u>	27.6	35.4	26.0	24.6	28.0	27.1	8.2
Mgr., Off. & Prop.	6.8	7.4	6.3	4.9	6.9	4.2	2.4
Clerical	14.9	19.6	14.9	16.8	12.9	19.9	5.7
Sales	5.9	8.4	4.8	2.9	8.2	3.0	0.1
<u>Service Workers</u>	0.1	0.4	0.2	0.4		2.4	1.2
<u>Blue Collar</u>	53.9	49.7	61.1	66.3	65.4	64.7	85.8
Skilled & Semi-skilled	43.8	33.1	48.6	35.5			15.5
Unskilled	10.1	16.6	12.5	30.8			70.3
TOTAL	97.0	94.8	99.0	100.1	99.6	97.9	100.0

INDUSTRY: ELECTRICAL MACHINE EQUIPMENT & SUPPLIES - ISIC No. 37

	U.S. 1960	Canada 1950	U.S. 1950	U.K. 1950	Japan 1960	Turkey 1960	India 1956
Prof. & Tech.	15.2	7.0	9.3	6.2	3.1	3.8	5.3
Professional	10.0	4.7	6.9	2.4			
Technical	5.2	2.3	2.4	3.8			
White Collar	20.1	19.5	19.1	18.0	22.4	8.4	8.6
Mgr., Off. & Prop.	4.3	0.8	3.2	3.3	3.1		1.3
						7.5	
Clerical	14.2	17.1	14.3	13.9	17.9		7.3
Sales	1.6	1.6	1.6	0.8	1.4	0.9	
Service Workers	0.1	0.3	0.3	0.2	0.8		0.3
Blue Collar	62.5	66.8	70.8	73.6	72.6	87.7	85.7
Skilled & Semi-skilled	57.7	59.0	65.5	58.3			42.7
Unskilled	4.8	7.8	5.3	15.3			43.0
TOTAL	97.9	93.6	99.5	98.0	98.9	99.9	99.9

INDUSTRY: PRINTING, PUBLISHING & ALLIED PRODUCTS - ISIC No. 28

	U.S. 1960	Canada 1950	U.S. 1950	U.K. 1950	Puerto Rico 1960	Japan 1960	Turkey 1960	India 1956
Prof. & Tech.	9.1	9.0	9.2	7.0	11.5	10.1	15.4	4.1
Professional	8.1	8.3	8.7	5.8	10.9			
Technical	1.0	.7	.5	1.2	.6			
White Collar	30.7	32.2	26.6	22.8	36.7	29.0	14.6	14.0
Mgr., Off. & Prop.	7.5	8.1	3.7	5.9	13.9	6.5		3.4
Clerical	17.2	19.0	17.5	14.7	12.9	17.8	13.8	10.4
Sales	6.0	5.1	5.4	2.2	9.9	4.7	.8	0.2
Service Workers	0.1			0.1		0.5	2.3	1.0
Blue Collar	57.1	57.2	58.2	67.8	51.9	59.2	67.6	80.8
Skilled & Semi-skilled	38.0	48.3	44.8	53.4				53.4
Unskilled	19.1	8.9	13.4	14.4				27.4
TOTAL	97.0	98.4	94.0	97.7	100.1	98.8	99.9	99.9

INDUSTRY: MACHINERY EXCEPT ELECTRICAL - ISIC No. 36

	U.S. 1960	U.S. 1950	U.K. 1950	Puerto Rico 1960	Japan 1960	Turkey 1960
Prof. & Tech.	9.2	6.8	5.9	3.3	2.4	4.5
Professional	6.1	4.9	1.7	2.6		
Technical	3.1	1.9	4.2	.7		
White Collar	21.2	21.1	16.9	10.6	20.8	
Mgr., Off. & Prop.	5.6	4.9	4.3	3.6	5.1	
						13.6
Clerical	13.2	13.6	11.7	6.0	13.9	
Sales	2.4	2.6	0.9	1.0	1.8	
Service Workers	0.1	0.1	0.1		1.1	4.5
Blue Collar	67.2	71.4	78.1	86.2	74.4	77.3
Skilled & Semi-skilled	62.3	65.6	63.1			
Unskilled	4.9	5.8	14.0			
Total	97.7	99.4	100.0	100.1	96.7	99.9

INDUSTRY: APPAREL & OTHER FINISHED TEXTILE PRODUCTS - ISIC No. 243 and 244

	U.S. 1960	Canada 1950	U.S. 1950	U.K. 1950	Puerto Rico 1960	Japan 1960	Turkey 1956
Prof. & Tech.	1.0	1.2	1.0	0.1	0.3	0.3	0.1
Professional	0.4	1.2	0.3	-0-	0.2		
Technical	0.6	-0-	0.7	0.1	0.1	0.3	
White Collar	13.7	15.5	13.0	10.6	5.9	11.3	7.4
Mgr., Off. & Prop.	4.0	5.6	4.6	4.2	2.4	0.6	
Clerical	7.1	7.3	6.4	5.1	2.7	4.9	7.2
Sales	2.6	2.6	2.0	1.3	0.8	5.8	0.2
Service Workers	0.3	0.6	0.3	0.2		0.2	0.1
Blue Collar	83.4	82.5	85.0	88.7	93.7	85.7	92.4
Skilled & Semi-skilled	80.1	78.3	83.1	82.6			
Unskilled	3.3	4.2	1.9	6.1			
TOTAL	98.4	99.8	99.3	99.6	99.9	97.5	100.0

INDUSTRY: FURNITURE AND FIXTURES - ISIC No. 26

	U.S. 1960	U.S. 1950	U.K. 1950	Japan 1960	Turkey 1960
Prof. & Tech.	2.0	1.5	0.9	0.2	0.8
Professional	1.2	0.9	0.3		
Technical	0.8	0.6	0.6		
White Collar	17.5	15.4	11.9	13.9	9.9
Mgr., Off. & Prop.	5.4	5.2	4.4	3.9	9.1
Clerical	9.1	7.8	6.0	5.0	
Sales	3.0	2.4	1.5	5.0	0.8
Service Workers		0.1	-0-	0.3	
Blue Collar	80.5	83.1	87.2	85.6	89.3
Skilled & Semi-skilled	73.1	75.5	77.1		
Unskilled	7.4	7.6	10.1		
TOTAL	100.0	100.1	100.0	100.0	100.0

INDUSTRY: PRIMARY METALS - ISIC No. 34

	U.S. 1960	U.S. 1950	U.K. 1950	Japan 1960
Prof. & Tech.	5.5	4.1	3.2	2.5
Professional	4.0	3.1	1.4	
Technical	1.5	1.0	1.8	
White Collar	13.9	12.8	11.8	17.7
Mgr., Off. & Prop.	2.7	2.4	2.5	3.0
Clerical	10.1	9.6	9.0	13.9
Sales	1.1	0.8	0.3	0.8
Service Workers	0.2	0.2	0.1	2.1
Blue Collar	77.4	81.1	85.0	75.1
Skilled & Semi-skilled	61.2	60.7	55.0	
Unskilled	16.2	20.4	30.0	
TOTAL	97.0	98.2	100.1	97.4

INDUSTRY: LUMBER AND WOOD PRODUCTS EXCEPT FURNITURE - ISIC No. 25

	U.S. 1960	U.S. 1950	U.K. 1950	Japan 1960	Turkey 1960
Prof. & Tech.	1.2	0.7	0.8	0.1	
Professional	.6	.4	.4		
Technical	.6	.3	.4		
White Collar	12.9	11.6	10.7	13.8	5.5
Mgr., Off. & Prop.	6.1	6.3	4.4	4.4	5.3
Clerical	5.5	4.4	5.7	6.7	
Sales	1.3	0.9	0.6	2.7	0.2
Service Workers			0.1	0.5	.2
Blue Collar	83.7	86.8	88.5		
Skilled & Semi-skilled	60.7	62.1	68.3		
Unskilled	23.0	24.7	20.2		
Total	97.8	99.1	100.1	--	--

INDUSTRY: IRON AND STEEL - ISIC No. 341

	U.S. 1960	Canada 1950	U.S. 1950	U.K. 1950	India 1956
Prof. & Tech.	4.7	3.0	3.7	2.6	6.7
Professional	3.3	2.4	2.8	1.1	
Technical	1.4	0.6	0.9	1.5	
White Collar	12.8	19.0	12.2	11.2	10.5
Mgr., Off. & Prop.	2.3	4.8	2.3	2.3	2.7
Clerical	9.7	12.3	9.2	8.7	7.8
Sales	0.8	1.9	0.7	0.2	
Service Workers	0.1	0.4	0.3	0.4	2.4
Blue Collar	79.6	77.0	81.7	85.8	80.4
Skilled & Semi-skilled	61.3	63.4	60.1	54.9	35.7
Unskilled	18.3	13.6	2.16	30.9	44.7
TOTAL	97.2	99.4	97.9	100.0	100.0

INDUSTRY: RUBBER PRODUCTS - ISIC No. 30

	U.S. 1960	Canada 1950	U.S. 1950	U.K. 1950	Japan 1960	Turkey 1960
Prof. & Tech.	6.0	4.2	5.4	3.2	1.5	1.3
Professional	4.4	2.8	3.9	1.3		
Technical	1.6	1.4	1.5	1.9		
White Collar	19.3	18.9	18.9	16.7	15.3	
Mgr., Off. & Prop.	4.5	3.7	3.4	3.3	2.2	
Clerical	12.1	13.8	13.4	11.8	10.6	8.0
Sales	2.7	1.4	2.1	1.6	2.5	
Service Workers	0.2		0.3	0.1	0.6	1.3
Blue Collar	71.5	75.8	74.2	77.7	81.3	89.3
Skilled & Semi-skilled	62.6	63.8	65.0	53.4		
Unskilled	8.9	12.0	9.2	24.3		
TOTAL	97.0	98.9	98.8	97.7	98.7	99.9

INDUSTRY: PAPER AND PAPER PRODUCTS - ISIC No. 27

	U.S. 1960	Canada 1950	U.S. 1950	U.K. 1950	Japan 1960	Turkey 1960
Prof. & Tech.	5.0	4.8	3.4	2.2	0.8	4.3
Professional	3.2	3.1	2.4	1.4		
Technical	1.8	1.7	1.0	0.8		
White Collar	18.1	15.4	16.8	15.0	17.2	
Mgr., Off. & Prop.	4.4	3.5	4.3	3.4	4.4	
Clerical	10.7	10.5	10.2	9.9	10.5	8.5
Sales	3.0	1.4	2.3	1.7	2.3	
Service Workers	0.1	1.1	0.2	0.3	1.1	6.4
Blue Collar	74.3	78.2	78.5	82.6	78.5	80.9
Skilled & Semi-skilled	62.5	53.2	66.0	54.6		
Unskilled	11.8	25.0	12.5	28.0		
TOTAL	97.5	99.5	98.9	100.1	97.6	100.1

INDUSTRY: STONE AND CLAY PRODUCTS - ISIC Nos. 331, 333, 334 and 339

	U.S. 1960	U.S. 1950	U.K. 1950	Turkey 1960	India 1956
Prof. & Tech.	4.6	4.1	1.9	2.0	2.5
Professional	3.3	3.2	1.0		
Technical	1.3	.9	.9		
White Collar	18.9	16.2	10.8	9.1	5.6
Mgr., Off. & Prop.	6.9	6.1	3.9	8.8	1.6
Clerical	9.3	8.3	6.2		4.0
Sales	2.7	1.8	0.7	.3	
Service Workers			0.7	3.0	1.5
Blue Collar	73.8	79.0	86.7	85.9	90.3
Skilled & Semi-skilled	56.2	57.4	59.0		24.3
Unskilled	17.6	21.6	27.7		66.0
TOTAL	97.3	99.3	100.1	100.0	99.9

INDUSTRY: PETROLEUM AND COAL PRODUCTS - ISIC No. 32

	U.S. 1960	Canada 1950	U.S. 1950	U.K. 1950	Japan 1960	Turkey 1960	India 1956
Prof. & Tech.	14.9	12.5	14.2	8.7	4.7	11.6	5.6
Professional	10.5	8.4	11.2	4.6			
Technical	4.4	4.1	3.0	4.1			
White Collar	26.3	24.0	25.1	14.7	30.9	11.6	6.2
Mgr., Off. & Prop.	5.8	4.9	5.9	2.4	5.2	11.6	2.0
Clerical	17.8	16.9	16.3	11.8	22.0		4.2
Sales	3.1	2.2	2.9	0.5	3.7		
Service Workers	0.3	1.6	0.2	0.3	5.2	5.8	1.0
Blue Collar	55.9	59.9	59.8	70.7	54.0	69.[illegible]	84.5
Skilled & Semi-skilled	47.3	45.9	47.1	39.7			24.2
Unskilled	8.6	14.0	12.7	31.0			60.3
TOTAL	97.4	98.0	99.3	94.4	94.8	98.9	97.3

INDUSTRY: FABRICATED METAL PRODUCTS - ISIC No. 39

	U.S. 1960	U.S. 1950	U.K. 1950	Japan 1960	Turkey 1960	India 1956
Prof. & Tech.	9.6	4.8	1.6	0.5	0.2	3.6
Professional	6.3	3.3	.6			
Technical	3.3	1.5	1.0			
White Collar	20.8	19.7	13.7	16.1	5.5	8.0
Mgr., Off. & Prop.	5.6	5.4	4.3	5.1		2.4
					5.3	
Clerical	13.1	11.9	8.8	9.2		5.5
Sales	2.1	2.4	0.6	1.8	.2	0.1
Service Workers	0.2	0.1	1.3	0.5	.3	0.8
Blue Collar	67.3	75.0	83.5	81.4	94.0	87.6
Skilled & Semi-skilled	60.1	66.5	64.4			45.6
Unskilled	7.2	8.5	19.1			42.0
TOTAL	97.9	99.6	100.1	98.5	100.0	100.0

INDUSTRY: NONFERROUS METALS - ISIC No. 342

	U.S. 1960	Canada 1950	U.S. 1950	U.K. 1950	India 1956
Prof. & Tech.	7.4	5.2	5.2	4.3	6.4
Professional	5.4	3.6	3.9	1.9	
Technical	2.0	1.6	1.3	2.4	
White Collar	17.5	17.3	15.7	13.9	9.4
Mgr., Off.& Prop.	4.2	4.1	3.3	3.4	1.0
Clerical	11.3	11.2	11.1	10.1	8.4
Sales	2.0	2.0	1.3	0.4	
Service Workers	0.1	0.2	0.4	0.2	5.4
Blue Collar	72.8	75.6	77.5	80.8	78.3
Skilled & Semi-skilled	63.0	59.8	62.6	54.1	33.6
Unskilled	9.8	15.8	14.9	26.7	44.7
TOTAL	97.8	98.3	98.8	99.2	99.5

INDUSTRY: TRANSPORTATION EQUIPMENT - ISIC No. 38

	U.S. 1960	Canada 1950	U.S. 1950	U.K. 1950	Japan 1960	India 1956
Prof. & Tech.	12.4	2.8	6.4	3.9	3.6	4.0
Professional	9.3	1.9	4.8	1.2		
Technical	3.1	0.9	1.6	2.7		
White Collar	16.4	16.1	15.2	11.5	18.1	8.3
Mgr., Off. & Prop.	2.8	5.1	2.5	2.0	2.2	1.7
Clerical	12.8	9.7	11.8	9.2	15.0	6.6
Sales	0.8	1.3	0.9	0.3	0.9	
Service Workers	0.2	0.5	0.3	0.3	1.5	0.7
Blue Collar	68.9	80.6	77.4	84.1	76.7	87.2
Skilled & Semi-skilled	63.2	68.6	70.0	66.3		50.2
Unskilled	5.7	12.0	7.4	17.8		37.0
TOTAL	97.9	100.0	99.3	99.8	99.9	100.2

INDUSTRY: TOBACCO AND TOBACCO PRODUCTS - ISIC No. 22

	U.S. 1960	Canada 1950	U.S. 1950	U.K. 1950	Japan 1960	Turkey 1960
Prof. & Tech.	1.8	1.2	0.9	0.9	2.2	
Professional	1.1	1.2	.7	.2		
Technical	.7	-0-	.2	.7		
White Collar	15.4	20.2	12.4	21.9	31.5	4.5
Mgr., Off. & Prop.	4.0	3.6	3.7	2.9	4.1	
Clerical	7.1	14.2	6.5	16.1	26.5	2.5
Sales	4.3	2.4	2.2	2.9	0.9	2.0
Service Workers			0.1	0.2	4.1	1.5
Blue Collar	81.9	73.1	86.4	73.1	60.3	94.0
Skilled & Semi-skilled	62.1	54.3	75.3	61.0		
Unskilled	19.8	18.8	11.1	12.1		
TOTAL	99.1	94.5	99.8	96.1	98.1	100.0

SOURCES

UNITED STATES:

U.S. Bureau of the Census, U.S. Census of Population: 1960, Subject Report, Occupations by Industry, Final Report PC (2) - 7C (Washington, D. C., 1963); and U.S. Bureau of the Census, U.S. Census of Population: 1950, Vol. IV, Special Report, Part I, Chapter C, Occupation by Industry (Washington, D.C., 1954).

CANADA:

Dominion Bureau of Statistics, Ninth Census of Canada: 1951, Vol. IV, Labor Force, Occupations and Industries (Ottawa, 1953).
Her Majesty's Stationary Office, Census, England and Wales: 1951, Industry Tables (London, 1954).

PUERTO RICO:

U.S. Bureau of the Census, U.S. Census of Population: 1960, Detailed Characteristics of Puerto Rico, Final Report PC (1) - 53 D (Washington, D.C., 1962).

JAPAN:

Office of the Prime Minister, Bureau of Statistics, Population of Japan: 1960, Summary of the Results of 1960 Population Census of Japan.

TURKEY:

Special tabulation prepared by the State Institute of Statistics, from data in State Institute of Statistics, Census of Population: 23 October 1960.

INDIA:

Government of India Planning Commission, Occupational Pattern in Manufacturing Industries, India, 1956 (Delhi, 1959)

Note that data for Canada and the United Kingdom are for 1951. The year 1950 was used in the Tables for simplicity. Also, United Kingdom data omit Scotland.

Appendix III

PERCENTAGE DISTRIBUTION OF WORKERS IN SELECTED OCCUPATIONS IN DIFFERENT COUNTRIES BY YEARS OF FORMAL SCHOOLING a/

DRAFTSMEN & DESIGNERS

	0-4		5-8	9-12	13 +	
Canada, 1951	--		8	57	35	
Japan, 1950	--		23	53	23	
U.K., 1951		29		63	4	4 n.s.
U.S., 1960	--		3	49	47	

CASHIERS & BOOKKEEPERS

Years of Schooling

	0-4		5-8	9-12	13 +	
Canada, 1951	--		11	71	17	
Japan, 1950	--		23	59	17	
U.K., 1951		39		55	1	4 n.s.
U.S., 1960	--		8	73	18	

SECRETARIES, STENOGRAPHERS & TYPISTS

Years of Schooling

	0-4		5-8	9-12	13 +	
Canada, 1951	--		5	77	18	
Japan, 1950	--		21	71	8	
U.K., 1951		29		65	1	5 n.s.
U.S., 1960	--		2	72	26	

TELEPHONE OPERATORS

Years of Schooling

	0-4		5-8	9-12	13 +	
Canada, 1951	--		18	77	5	
Japan, 1950	--		58	41	1	
U.K., 1951		55		39	--	6 n.s.
U.S., 1960	--		13	80	8	

---

a/ See Page 47 for sources.

TOOL & DIE MAKERS

Years of Schooling

	0-4		5-8	9-12	13 +	
Canada, 1951	2		29	58	11	
Japan, 1950	6		73	23	--	
U.K., 1951		70		24	--	5 n.s.
U.S., 1960	1		24	66	9	

PAINTERS & PAPERHANGERS

Years of Schooling

	0-4		5-8	9-12	13 +	
Canada, 1951	6		55	36	3	
Japan, 1950	6		72	21	2	
U.K., 1951		80		13	--	6 n.s.
U.S., 1960	7		42	45	5	

BRICKLAYERS & MASONS

Years of Schooling

	0-4		5-8	9-12	13 +	
Canada, 1951	9		57	31	3	
Japan, 1950	11		75	18	--	
U.K., 1951		82		11	--	8 n.s.
U.S., 1960	7		37	51	5	

ELECTRICIANS

Years of Schooling

	0-4		5-8	9-12	13 +	
Canada, 1951	2		35	55	8	
Japan, 1950	1		60	33	5	
U.K., 1951		67		27	--	5 n.s.
U.S., 1960	1		23	65	10	

PLUMBERS & PIPE CUTTERS

Years of Schooling

	0-4		5-8	9-12	13 +	
Canada, 1951	4		51	42	3	
Japan, 1950	3		74	19	3	
U.K., 1951		76		18	--	6 n.s.
U.S., 1960	4		34	57	5	

AUTO MECHANICS

Years of Schooling

	0-4		5-8	9-12	13 +	
Canada, 1951	4		51	41	3	
Japan, 1950	1		66	29	4	
U.K., 1951		68		25	--	6 n.s.
U.S., 1960	4		36	55	4	

WEAVERS

Years of Schooling

	0-4		5-8	9-12	13 +	
Canada, 1951	4		67	26	2	
Japan, 1960	4		74	20	1	
U.K., 1951		84		9	1	6 n.s.
U.S., 1960	10		51	39	1	

TAILORS & DRESSMAKERS

Years of Schooling

	0-4		5-8	9-12	13 +	
Canada, 1951	7		52	38	3	
Japan, 1960	4		59	35	3	
U.K., 1951		70		19	--	11 n.s.
U.S., 1960	17		49	31	4	

CABINET MAKERS

Years of Schooling

	0-4		5-8	9-12	13 +	
Canada, 1951	6		50	40	4	
Japan, 1950	7		75	17	1	
U.K., 1951		70		22	--	7 n.s.
U.S., 1960	5		36	51	7	

COMPOSITORS & TYPESETTERS

Years of Schooling

	0-4		5-8	9-12	13 +	
Canada, 1951	--		29	63	7	
Japan, 1950	3		69	28	2	
U.K., 1951		71		23	1	5 n.s.
U.S., 1960	1		18	69	10	

MOLDERS & COREMAKERS

Years of Schooling

	0-4		5-8	9-12	13 +	
Canada, 1951	8		57	32	3	
Japan, 1950	5		76	17	2	
U.K., 1951		85		8	--	6 n.s.
U.S., 1960	9		46	52	3	

CARPENTERS & JOINERS

Years of Schooling

	0-4		5-8	9-12	13 +	
Canada, 1951	11		59	28	2	
Japan, 1950	8		80	12	1	
U.K., 1951		75		19	--	7 n.s.
U.S., 1960	7		41	47	5	

SOURCES: See Appendix II, for all but the United States. United States educational data were computed from U.S. Bureau of the Census, U.S. Census of Population: 1960, Special Reports, Occupational, Characteristics, Final Report PC (2) - 7A (Washington, D. C., 1963).

G-676

78.11.13