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INTRODUCTION TO LABOUR FORCE PROJECTION

(Paper prepared by the International Labour Office)

1.   Information about the future size and composition of population and
labour force is of fundamental importance to governments contemplating long-
term plans for social and economic development.

2.   Even in countries where centralized or comprehensive economic and
social planning is not carried out, such information serves as a basis for
action towards solution or ameliorisation of particular economic and social
problems which may be anticipated according to the trends indicated by the
projections.

3.   Projections of the total population provide a basis for estimating
future requirements for various categories of goods and services, including
food, clothing, housing, transportation, communication, education and health
facilities, and so on. The labour force projections provide estimates of
the future supply, distribution and composition of labour available for the
production of goods and services and, at the same time, the future demand
for jobs. The latter are therefore an essential preliminary to formulation
of employment policy.

4.   Changes in the size and composition of the population and labour
force are key factors in economic development which essentially consists
of raising per capita national income, or national productivity in a general
sense. A nation's ability to produce is dependent to a great extent on the
size and skill of its labour force.

A nation's level of living on the other hand is dependent on its production in relation to the size and sex-age distribution of its total population. Taken together, population and labour force projections provide a vital part of the basic information required for formulating programmes of economic development.

5. This paper is primarily concerned with some of the technical and methodological problems of estimating the future labour supply and to a lesser degree with the problem of estimating the future total population from which labour is drawn.[1] However, labour force projections are dependent on population projections and are usually made in conjunction with these, at least in so far as the population of working age is concerned. In this respect, the labour force can be viewed as a function of the size and sex-age composition of the total population and the extent to which each sex-age group participates in the economic life of the society. The size and sex-age composition of the population can be ascertained more easily and with greater reliability than the size and composition of the labour force.

6. The basic operational procedures in labour force projections consist of:

(1) assembling for at least several decades if possible detailed information on:

    (i) the size, composition and distribution of the total population and the elements of change (fertility, mortality and migration); and

    (ii) the population classified as economically active at the same dates, i.e. - the composition and distribution of the labour force by sex-age, urban-rural residence, education, marital status, etc.;

(2) determining the past trends;

(3) determining, if possible, the factors associated with the past trends, i.e. the causes of the changes noted in the past;

(4) framing assumptions as to the future course of the trends by assessing the effects of different factors likely to cause future changes in the trends;

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[1] Total population projections are only briefly touched on in this paper. For detailed information see United Nations, Methods for Population Projections by Sex and Age, ST/SOA/Series A/No. 25, New York 1956.

(5)   finally, calculating the changes which these assumptions imply.

7.   The framing of hypothesis regarding future trends is of critical importance. Whether stated or not most projections assume that there will be a continuation of the fundamental social and economic forces operating in the country, that there will be no major national or international depressions, political upheavals or wars, that there will be no major technical innovations and also, that there will be no major catastrophic events such as floods or earthquakes. Assumptions regarding future trends in fertility, mortality, migration and patterns of labour force participation, however, must be clearly stated as are any expectations regarding the impact and likely prospects of future investments, plans for construction of plants, power, communication and transportation facilities, etc.

8.   Ideally, two sets of basic statistics should be available, each pertaining to the same time span.

The first set of data desired are:

(i)   a complete count of the population by sex and age:

(ii)   total number of births per year of each sex;

(iii)   total number of deaths per year of each sex by age;

(iv)   a count of migrants, in and out respectively, by sex, age and economic characteristics;

(v)   distribution of population by region, urban-rural residence, marital status and educational attainment;

(vi)   and for assessing future trends in fertility, it is desirable to have also information on the average family size, age at marriage, age of mother at birth of children and the marriage rate.

The second set of data are:

(i)   a complete count of the total economically active population by sex and age;

(ii)   the distribution of the economically active males and females by industry, occupation and status (employer, employee, etc.);   and

(iii)   the distribution of the economically active population by sex and by region, residence, marital status, and level of education.

In addition it is desirable to have information on: general attitudes towards employment, particularly as regards females; the prevalence of retirement schemes; work and school attendance laws; the standard of living, levels of income and wealth of population, and any information on future investments and plans for construction of plants, dams, highways, rail lines, schools, hospitals, etc. All of these enter into the framing of assumptions regarding future trends in the factors affecting population and labour force changes.

9. In most countries all of the above data are not available at least not for more than one date. The initial projection procedures then consist of filling in the gaps in information either by estimating the unknowns or by "borrowing" data[1], that is, by analogy. The selection of any particular projection method will be governed by the purpose of the projection, the accuracy and detail desired and, last but not least, the available data and information at hand.

10. Basic sources for the above statistics include population census reports, vital statistics registers, migration reports, household surveys (labour force sample surveys) and industrial, educational and other surveys and reports. Information as to the range and distribution of various demographic and economic factors and rates for model-building purposes can be obtained from publications issued by the United Nations and its specialised agencies.

11. Some of the preliminary tasks to be performed prior to working out the projections themselves are:

(i)   checking the reliability and internal consistency of the available data and where possible adjusting errors;

(ii) filling the gaps in information by various estimation procedures;

(iii) bringing some of the statistics forward to the starting date of the projections; and

(iv) choosing the projection end years.[2]

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[1] Statistics may be borrowed from other countries deemed similar in demographic, economic, socio-cultural and geographical aspects to the borrower country, from regional patterns or from models constructed for the purpose.

[2] The projections should tie into official development plans and target dates. It is also preferable to project in 5 or 10-year intervals since age data are conventionally shown in standard 5-year age groupings.

12. The second phase of the projection procedures entails the projection of the total population. As previously noted much depends on the data and information at hand. A variety of methods can be employed for the projection of the total population.

If no details on births and deaths and on the composition and distribution of the population are available, rough population projections may be derived by simple methods such as extrapolation, e.g. arithmetic mean, geometric mean, parabolic extrapolation, curve-fitting, or by applying assumed annual rates of growth.[1] Annual rates of growth are generally estimated on the basis of past growth trends if known, otherwise they may be based on observed rates of the region, or of certain selected neighbouring countries, or models. Another method is to estimate (or borrow) fertility and mortality rates, compute rates of natural increase and adjust the population accordingly, taking into account migration estimates or assumptions.

13. Where some information exists on the distribution of population (geographic regions, urban-rural residence and certain socio-economic categories), and on the various growth patterns of these population segments, the total population projections may be derived by applying the different rates of growth to each segment or else by computing a weighted-average rate of growth for all segments combined.

14. Provded some information on the sex-age composition of the population is available, one can estimate the annual male and female births up to the end of the projection period. For each year the number of survivors in each sex-age cohort can be computed by applying mortality rates for each age group and adjusting the result for changes in sex-age distribution due to net migration. If the information on fertility, mortality and migration is not complete, the rates can be estimated or borrowed. The various procedures are mentioned here only briefly to illustrate the variety of methods and choices of assumptions to be made when projecting the total population from the base year (usually a census date) to a future year.[2]

15. The third phase is the projection of the total labour force. Here again much depends on the information at hand, including the amount of detail it has been possible to give in the total population projections. One of the most important determinants of the labour force participation rates of a country is its age structure. Countries with high rates are generally those with a high proportion of their population of working age. This applies especially to the male

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[1] For detail discussion on methods of extrapolation, see United Nations Methods of Estimating Total Population for Current Dates ST/SOA/Series A/No. 10, New York, 1952, pp. 28-37.

[2] For detail discussion of projection methodology for total population, see United Nations, Methods for Population Projection by Sex and Age ST/SOA/Series A/No. 25, New York, 1956.

population whereas the activity rates of females are greatly
influenced by social and cultural factors. High participation rates
are also found in agricultural economies irrespective of the age
distribution of the population.[1]

The amount of detail which can be given in the labour force
projections is governed by the amount of detail presented in the
total population projections and also by the availability of data for
past periods concerning the size and structure of the labour force.
If details by sex and age in the total population projections are
lacking, it is not possible to show sex-age details for labour force
projections. In such cases an assumed crude over-all activity rate for
each sex (per cent. of total population of each sex economically
active) is applied to the projected total population to derive the
estimated total labour force figures. The crude activity rates
selected for the projection dates:

(i)   could be the same as those shown for the benchmark date if
      one has reason to assume that the rates will remain stable
      (this would not often be the case however); or

(ii) they can be modified to fit assumptions made as to the
      future trends in population, particularly in population of
      working age.

For example, information on the age structure of the total
population may be lacking but one has already assumed a certain rate
of future growth; this assumption has a corollary concerning the
possible future growth of the working age population. Particularly
in countries experiencing rapid declines in mortality and constant
fertility (which probably will be typical in the short-run of the
demographic trends in most developing areas in Africa), as a rule,
the total population will grow faster than the population of working
age. Rapid declines in mortality affect more particularly the popula-
tion groups under age 10 and over age 50 but these provide a relatively
small part of the labour force. In such circumstances the crude
activity rates generally decline.

If the activity rates for certain population segments at a recent
date are known, particularly for the urban and rural segments, one can
take into account the fact that in the future a higher proportion of
the population will be found in urban areas where activity rates are
lower than in rural areas.

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[1] For detailed discussion of crude activity rates by region
and country see United Nations Demographic Aspects of Manpower: Sex
and Age Patterns of Participation in Economic Activities
ST/SOA/Series A/No. 33, Chapter II, New York, 1962.

16. If one does have information on the age structure of the total population but no figures on the total labour force, the latter can be estimated by applying assumed crude activity rates to the population of working age. The working-age crude activity rates are more stable than the crude activity rates of the total population and are therefore preferable to the latter. The crude activity rates to be used for the purpose may be borrowed from similar neighbouring countries or from the region, or models. The crude activity rates for the working-age population in Africa in 1950 and 1960 were estimated at 78.1 per cent. and 77-9 per cent. respectively. For the same period, the labour force participation rates for the total population were estimated at 44.5 per cent. and 43.4 per cent. respectively.[1] Thus by assuming a crude activity rate of 78 per cent. for the working-age population, one can roughly estimate the labour force size for the benchmark period.

In the projections of labour force, the same rate can be applied to the projected population of working age at each future period, or else the rate may be shaded downward in anticipation of changes due to economic development, industrialisation or urbanisation. This procedure implies that the labour force will grow at the same (or less, if shaded) rate of growth as the population of working age.

17. If one has information on the sex-age structure of the total population and also figures of the total labour force by sex but no information on the sex-age structure of the labour force, the latter can be estimated. This is done by applying to the population assumed activity rates for each age. One could use rates which are typical of countries with similar characteristics - demographic, economic, socio-cultural and geographic - and compute the average sex-age-specific activity rates plus the standard deviation of each sex-age-specific activity rate for these model countries. The average sex-age-specific rates can then be applied to the respective sex-age cohorts of the total population to derive a first approximation of the age structure of the male and female labour force likely to be found in this population. The derived figures by age group must then be adjusted to agree with the given totals of the male and female labour force. This is accomplished by first computing the difference between the hypothetical (the totals of the age groups for both the male and female groups separately) and the actual totals for both the male and female labour force separately, and using these differences (hypothetical divided by actual) as a constant proportion or weight of the standard deviation of each sex-age-specific rate. The results in turn are added or subtracted, as the case may be, from each average sex-age-specific rate. This method will accordingly alter the average

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[1] Computed from data in I.L.O., _International Labour Review_, Vol. LXXXIII, No. 4, April 1961, Table II-A, p. 383.

sex-age activity rates so that they generate estimates which lock into
the given totals. By changing the average sex-age-specific rates in
accordance with a percentage of its standard deviation, age groups in
which the variation from country to country is large are adjusted more
than the age groups where the range among countries is small.[1]

18. The future patterns of labour force participation for each
sex-age group must be determined in order to complete the projection of
the total labour force at each future date selected.

A variety of methods have been used to adjust the benchmark sex-
age-activity rates for expected future changes. Here again much
depends on the information at hand pertaining to the present patterns
and past trends in labour force participation rates and the assumptions
made regarding the future. Assumptions have to be made at least
implicitly regarding migration from rural to urban areas, provisions
concerning retirement, legislation affecting work and school attendance,
and the likely trends in employment opportunities for females, etc.
All these may modify the sex-age-specific activity rates.[2]

19. By the method described in paragraph 17, one could also
construct model labour force participation tables typical of countries
at various stages of development or with selected characteristics, e.g.
as regards labour force composition, urban-rural distribution or
selected demographic characteristics. If it is possible to select
groups of countries which appear to be typical of the various stages
of growth or change which your country plans to pass through in a
specified interval of time, it would be possible to compute, using
the population projections, the expected size and composition of the
labour force for respective dates. Lacking sufficient country coverage
for model construction, one could borrow outright the rates of a country
which would closely represent the changed socio-economic and demographic
structure envisaged for one's own country at certain future dates.

The general trend in countries undergoing industrial development
is towards lower activity rates for youth and aged persons, particularly
for the male population. As regards the female population, where the
agricultural sector of the economy utilises a relatively large amount

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[1] For an example of the application of this method, see U.S.
Bureau of Census, The Labor Force of Czechoslovakia, by James N.
Ypsilantis, International Population Statistics Reports, Series P-90,
No. 13, Washington D.C., 1960, pp. 22 and 23.

[2] For patterns of labour force participation, see United Nations,
op. cit., ST/SOA/Series A/No. 33, New York, 1962.

of female labour, the shift to non-agricultural production tends to
first reduce the activity rates. The progress of industrialisation
and urbanisation accompanied by longer educational and vocational
training for girls brings about a greater demand for labour and
relaxation of many barriers to women's employment so that a growing
number of women are drawn into the labour force in the more advanced
stages of industrialisation.

20. The final and most difficult phase of labour force pro-
jections is the determination of the future distribution of the labour
force by industry, occupation and status. These projections call for
a general knowledge of development in the country and some common-
sense judgments on future trends. They also assume the availability
of detailed information for the benchmark date and some historical
data.

21. If the projections are for short periods, not more than say
five or ten years, it is generally fairly satisfactory to apply the
benchmark distributions to the future totals. There is frequently very
little significant change in such a short period. However, where one
has reason to believe marked changes will occur, due to massive
investments and changes inherent in the development plans, the dis-
tributions must be altered accordingly.

22. In projecting the benchmark industrial distribution of the
labour force, the first approximation to be made is the dichotomisation
of the labour force into agricultural and non-agriculture segments,
for each successive period. Much depends on the conditions peculiar
to each country, both as regards the extent of employment in agri-
culture and the future plans for developments.

23. In general, the movement of labour out of the agricultural
sector is a slow process. The proportion of labour engaged in agri-
cultural industries has for most countries in the past declined by
less than 1 percentage point per year. For example, during the past
50 years, the proportion of labour force engaged in agricultural
activities declined on the average each year approximately 0.8 of a
percentage point in the U.S.S.R.; 0.7 in Sweden; 0.6 in the U.S.A.,
France, Japan and Italy and 0.3 in Mexico and the U.A.R. During this
period, the number of persons engaged in agriculture dropped by
approximately 50 per cent. in the U.S.A. and France; in Italy, 35 per
cent.; and in Japan less than 10 per cent. In Mexico and the U.A.R.,
on the other hand, the agricultural labour force increased by 75 per
cent.[1]

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[1] For historical series on labour force activities by sector for
these and other countries, see I.L.O., Employment and Economic Growth,
Studies and Reports, N.S. No. 67, Geneva, 1964, pp. 8-10.

The projected, agricultural and non-agricultural sectors of the labour force should therefore make sense, in terms of the proportional changes experienced in the past and also in terms of the future development plans and investments of the country in question. Declines of more than 1.5 percentage points per year in the proportion of labour force engaged in agriculture should be viewed with scepticism since such a figure in a country with 70 per cent. of its labour force in agriculture would represent an expansion of 5 per cent. per annum in the non-agricultural labour force.

24. The non-agricultural sector in turn can be further subdivided into Industry and Service sectors. Estimate of the growth of the labour force in either one or the other of these sectors is again largely dependant on the general developments in the country and on the size and characteristics of the industries within each of these sectors for the past and benchmark periods. Such trends if discernible may be extrapolated into the future and accordingly modified to take account of planned action for development.

25. Having obtained projected totals for the Industry and Service sectors, the component industries within each sector must accordingly add up to these control totals for each sector.

On the basis of present size past growth patterns and relationships, and future plans for development of specific industries (manufacturing, mining and quarrying, construction, electricity, gas and water supply), the industrial subcategories are projected forward. First, projecting known or envisaged changes and secondly, either through ratio methods or proportional distribution, computing the residual industries so that they all add into the controlled totals for the Industry sector. Sometimes input-output tables can be used in this work.

In the same manner, subcategories of the Service sector (commerce, transport, storage and communications and public and private services) are likewise projected forward. Again, it must be repeated that much depends on the specific plans for development or future investments, the training and educational programmes in force, and the general historical size and composition of the non-agricultural labour force.

26. The labour force by occupation may be projected in a similar manner as the projection of labour force by industry and in fact may be tied into such projections through ratio projections. Thus, on the basis of past trends in the ratio relationships between I.S.C.O. Major Group 4 (farmers, fishermen, hunters, loggers and related workers) and I.S.I.C. Division 0 (agriculture, forestry, hunting and fishing) future ratios are estimated and applied to the projected I.S.I.C. Division 0 category to derive the first approximation estimates of the number of persons in I.S.C.O. Major Group 4 occupations.

By similar procedures I.S.C.O. Major Group 5 (miners, quarry men and related workers) can be tied into the projected trends for I.S.I.C. Division 1 (mining and quarrying) to derive first approximation projections. Other suggested groupings are: I.S.C.O. Major Group 6 (workers in transport and communications occupations) and I.S.I.C. Major Division 7 (transport, storage and communications); I.S.C.O. Major Group 7-8 (craftsmen, production process workers and labourers not elsewhere classified) with I.S.I.C. Major Division 2-3 (manufacturing and construction); I.S.C.O. Major Group 9 (service, sport and recreation) with I.S.I.C. Major Division 8 (service); and I.S.C.O. Major Group 2-3 (clerical and sales workers) with I.S.I.C. Major Division 6 (commerce). The remaining groups, I.S.C.O. Major Group 0 (professional, technical and related workers) and I.S.C.O. Major Group 1 (administrative, executive and managerial workers) must be independently estimated and, in any case, should not exceed the residual category, e.g. total labour force minus I.S.C.O. Major Groups 2 to 9.

Having thus projected the first approximation of the labour force by occupation, each Major Group can accordingly be adjusted to take account of the future planned output of schools and training programmes (graduates and apprentices), economic development plans and investments, past patterns of growth and planned expansion of specified establishments, etc. In any case the projections can only be viewed as rough approximations since there is no way of foretelling the future changes in occupations which will almost certainly come about through changes in productive processes, creation of new occupations (unknown), increased mechanisation, automation, etc. Where good occupational data exist, more refined methods may be applied based on detailed analysis of occupational trends.

27. Working with patterns of change by industry (I.S.I.C.) and by occupation (I.S.C.O.) and the past trends in these patterns vis-à-vis the pattern of labour force distribution by class of worker, one can arrive at some rough approximations of the future distribution of labour force in broad class of worker categories such as:

(i)   employers and own account workers;

(ii) salaried employees and wage earners;

(iii) family workers;

(iv) others.

On the basis of past changes in establishments' size and ownership trends, these projections can be further modified.

28. It is evident that the projection procedures are neither mechanical nor mathematical. The projections cannot be viewed as predictions for projections involve a certain amount of guessing as

to future trends and in any case, trends are not laws. The projected
estimates must be viewed only as statements of what the size and
composition of population and labour force is expected to be at
certain specified future dates _if_ the assumptions are confirmed i.e.
if births, deaths, migration and patterns of labour force participa-
tion rates, for the different population segments, follow the pattern
the projection maker expected. In the last analysis, all projections
are only as valid as the assumptions on which they are based. The
methods one uses and the reliability of the results are largely
dependent on the kinds and types of data available. With less data
the procedures are simple and the results lack detail and are rough
approximations. With more detailed information, more refined
methodology can be applied although the results, though not lacking
in detail must nevertheless be viewed as rough approximations. This
paper has attempted to show some of the various methods, simple
and complex, one can use to expand labour force data.

In closing, it should be noted that projections which show greater
detail than that available for the benchmark period should always be
treated with extreme caution. In addition, it should also be noted
that the reliability of the projections diminish as the projections
extend further into the future. Therefore, the projections should
be continuously revised in the light of new information and of more
accurate information, and, of course, of any unforeseen developments.