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THE MEASUREMENT OF GROSS DOMESTIC CAPITAL FORMATION IN UNDER-DEVELOPED  
COUNTRIES

(Memorandum by the Secretary-General)

I. INTRODUCTION

1. The subject of capital formation statistics in under-developed countries was discussed by the Statistical Commission at its tenth session (28 April - 15 May 1958). The basis of the discussion was the Secretary-General's memorandum on capital formation statistics which the Statistical Commission had requested at its ninth session.<sup>1/</sup> This memorandum dealt with the general approach to the problem of measuring capital formation in under-developed countries with emphasis on the statistical and methodological difficulties encountered and suggestions for overcoming some of these difficulties. On the basis of a survey of many countries the memorandum concluded that "proposals for a common programme for the collection and presentation of statistics of capital formation with emphasis on the needs of under-developed countries cannot realistically be made at the present time".

2. The Statistical Commission observed that the memorandum by the Secretary-General served a useful purpose in bringing to light the difficulties confronting under-developed countries concerned with improving statistics in that field. It was also of the opinion that the Secretary-General should follow developments in the field of capital formation statistics, especially in the less developed countries, continue to assess critically the methods and sources employed, and in general assist countries in all ways possible.<sup>2/</sup>

<sup>1/</sup> Doc. E/CN.3/227.

<sup>2/</sup> See Doc. E/3126, paras. 67-70.

## II. RECENT DEVELOPMENTS

3. The above-mentioned memorandum by the Secretary-General together with a joint ECAFE Secretariat-Statistical Office document dealing with the problems of estimating capital formation in the ECAFE region formed the basis of some preliminary discussion on the subject by the second session of the Conference of Asian Statisticians in Bangkok (8-19 December 1958).<sup>3/</sup> The Conference recognized the importance of capital formation estimates for purposes of planning and development but felt that the subject matter was too technical to be dealt with in detail by a plenary session. Accordingly, a Working Group of Experts on Capital Formation was convened in Bangkok (16-27 November 1959) under the auspices of the Conference of Asian Statisticians with the co-operation of the United Nations Bureau of Technical Assistance Operations. The Expert Group confined itself mainly to practical problems, such as a critical assessment of the methods and sources employed in estimating capital formation in the ECAFE countries and a discussion of ways to improve the estimates on the basis of available data. A paper prepared by the ECAFE Secretariat on problems in estimating capital formation,<sup>4/</sup> comments on this paper received from Asian countries and papers contributed by ten Asian countries giving detailed information on the methods they use in estimating capital formation served as working documents for the Expert Group. The final report of the Group summarizes and appraises critically what the Asian countries are doing in this difficult area of economic statistics.<sup>5/</sup>

4. The subject of capital formation was also on the agenda of the recent United Nations Seminar on National Accounts for Latin America.<sup>6/</sup> Several papers, prepared by national experts, describe in varying detail the methods used and problems encountered in connexion with the measurement of capital formation and are thus an invaluable source of information, especially in view of the fact that many of the details have hitherto not been published.

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<sup>3/</sup> Doc. E/CN.11/ASTAT/Conf.2/L.1.

<sup>4/</sup> "Some Problems in Estimating Capital Formation for ECAFE Countries" (paper prepared by the ECAFE Secretariat for the Working Group of Experts on Capital Formation).

<sup>5/</sup> Doc. E/CN.11/518.

<sup>6/</sup> Item 1(c) of the agenda: Methodological problems in national income accounting (joint session with the International Association for Research in Income and Wealth) - Capital formation and its distribution. See "Report of the United Nations Seminar on National Accounts for Latin America", Rio de Janeiro, Brazil, June 1959.

5. Data on the methods employed and practical difficulties encountered by African countries engaged in making estimates of capital formation were obtained primarily from available published sources. This information, together with that obtained from the Asian and Latin American documents mentioned above, constitute the bulk of the background material on which the present paper is based. It should be noted that capital formation statistics was on the agenda of the Fourth Conference of British Commonwealth Statisticians which met in London in 1956 and the contributed papers and discussions on this subject were also found to be very useful.

### III. PURPOSE OF PAPER

6. The purpose of the present paper is, on the basis of present knowledge and in the light of recent developments, to examine and appraise critically in summary fashion the methods and procedures employed by developing countries in Africa, Asia and Latin America in measuring capital formation, to suggest ways whereby the practical difficulties encountered may be overcome or at least alleviated, and to provide some guidance as to how estimates may be improved. It is hoped that these suggestions will be helpful not only to countries at present engaged in preparing estimates of capital formation but will also encourage other countries with a minimum of basic statistics to embark upon a programme of capital formation statistics as part of an over-all programme of measuring national income and expenditure and other related aggregates.

7. The present paper does not deal with conceptual problems of capital formation, except in so far as they are directly related to the present context, since these have been treated in various Statistical Office publications, in earlier reports prepared for the Statistical Commission, and in documents of the Working Group on Statistics of Fixed Capital Formation, Conference of European Statisticians.<sup>7/</sup> Nor does the paper deal with the social and economic implications of capital formation. It cannot be overemphasized, however, that reliable estimates of capital formation

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<sup>7/</sup> See, for example, A System of National Accounts and Supporting Tables, (Series F, No. 2, Rev.1); Concepts and Definitions of Capital Formation, (Series F, No. 3); Methods of National Income Estimation (Series F, No. 8); Doc. E/CN.3/207; Doc. Conf. Eur. Stats/WG.3/26.Rev.2.

and its distribution are particularly important for countries in the process of development. These are normally countries with rapidly increasing populations and it is imperative to know to what extent capital requirements are being met to increase employment opportunities and to raise productivity and living standards.

#### IV. SYNOPTIC TABLE

8. The table below gives a general view of the approach taken by countries in Africa, Asia and Latin America in estimating total gross capital formation, of the way the estimates are classified and the treatment of some of their components. Only those countries are included for which reasonably complete information on methodology is available.

#### V. ANALYSIS AND APPRAISAL OF METHODS USED

##### (a) Imports of machinery and equipment

9. As indicated in the synoptic table nearly all of the countries surveyed use the commodity-flow ("supply") approach as distinguished from the expenditure ("demand") approach in estimating gross capital formation in machinery and equipment. In the former method indirect estimates are made on the basis of net imports and domestic production of capital goods, while in the latter method the estimates are obtained directly from the expenditure accounts of government, industrial and commercial enterprises, railroads, utility companies, etc. While both approaches have advantages and disadvantages which in part complement each other, the methods used by countries are largely determined by the nature of available statistics. The predominant use of the commodity-flow method by underdeveloped countries is explained by the fact that the bulk of transportable capital goods are imported and that foreign trade statistics are usually available (though not always in sufficient detail to distinguish satisfactorily capital goods, intermediate goods and consumption goods). This is not to say that these countries do not use the expenditure method for making sector estimates. Actually, all countries measure capital formation in the public sector (i.e., general government and government enterprises) on the basis of government budgets or expenditure accounts and generally obtain an estimate of private investment as a residual by

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Summary of Available Information on Methods of Estimating Capital Formation

(X = Yes, - = No; ... = Information not available)

Region and Country	General approach					Changes in stocks				Depreciation				Classification of gross fixed capital formation			Capital formation estimated in constant prices	Inclusion of own-account rural construction	Agricultural improvements	Inclusion of military construction and equipment
	Machinery and equipment		Construction <sup>1/</sup>			Coverage		Valuation basis		Valuation basis			By type of asset	By industrial use	Private vs public sector					
	Commodity flow	Expenditure	Building permits or other records	Cost of inputs	Expenditure	Complete	Partial	Book Value	Value of physical change	Original cost	Replacement cost	Unspecified				No estimate made				
AFRICA																				
Algeria	X	-	X	-	-	X	-	...	...	X	-	-	-	X	X	X	...	...	X	...
Belgian Congo	X	-	X	-	-	2/	2/	2/	2/	-	-	X	-	...	...	X	X	...	...	...
Egypt	X	-	X	-	-	-	X	...	...	-	-	-	X	X	X	X	-	-	X	...
French West Africa, Former	X	-	-	-	X 3/	-	X	...	...	X	-	-	-	X	X	X	-	-	X	...
Ghana	X	-	X 4/	-	X 5/	-	X	...	...	-	-	-	-	-	X	X	-	-	X	...
Mauritius	X	X	-	-	-	X	-	...	...	X	-	-	-	-	X	-	X	-	X	...
Morocco	X	-	X	-	-	-	X	...	...	X	-	-	-	X	X	X	X	-	X	...
Nigeria	X	-	-	X	-	-	X	...	...	-	-	X	-	X	X	X	X	-	X	...
Rhodesia and Nyasaland, Fed. of	X	-	X	-	-	-	-	-	-	-	-	X	-	X	X	X	X	-	X	...
Tanganyika	X	-	X	-	-	-	-	-	-	-	-	-	X	X	X	X	-	-	X	...
Uganda	X	-	X	-	-	-	-	-	-	-	-	-	X	X	-	X	-	-	-	...
ASIA																				
Burma	X	-	-	X	-	X	-	X 6/	-	-	-	X	-	-	-	X	X	...	...	X
Ceylon	X	X 7/	-	X	-	2/	2/	2/	2/	-	-	X	-	X	-	X	X	...	...	X
China (Taiwan)	-	X	X 8/	-	X	-	-	-	-	X	-	-	-	X	X	X	-	-	X	...
India	-	-	X 8/	X	X	-	-	-	-	-	-	-	X 10/	...	...	X	X	...	...	X
Japan	-	X	X 11/	-	X	-	-	X 2/	-	-	-	-	-	X	-	X	-	-	X	X 12/
Malaya and Singapore, Fed. of	X	-	X	-	-	-	X	X	X	-	-	-	-	X	X	X	-	-	X	...
Philippines	X	-	X	-	-	-	X 13/	X	X	-	X	-	-	X	X	X	X	-	X	...
Thailand	X	-	-	X	-	-	-	-	-	-	-	-	X	-	-	X	-	-	...	X 14/
Viet-Nam, Republic of	X	-	-	X	-	-	-	-	-	-	-	-	-	-	-	X	-	-	...	...
LATIN AMERICA																				
Argentina	X	-	X	-	-	-	X	...	...	X	-	-	-	X	-	X	X	-	...	...
Brazil	X	-	X	-	-	2/	2/	2/	2/	-	-	X	-	-	-	X	X	...	...	...
Chile	X	-	X	-	-	-	X	X	X	-	-	X	-	-	-	X	-	...	...	...
Colombia	X	-	X	-	-	-	X	X	X	-	-	X	-	-	X	X	X	...	...	X
Honduras	X	-	-	X	-	X	-	-	X	-	-	-	-	X	-	X	-	-	...	...
Panama	X	-	-	X	-	-	X	...	...	-	-	-	-	X	X	X	-	-	...	...
Peru	X	-	X	-	-	X	-	X	X	-	-	X	-	X	X	X	-	-	...	...
Puerto Rico	X	-	X	-	-	X	-	X 15/	-	X	-	-	-	X	-	X	X	...	...	...

<sup>1/</sup> Relates to private construction only since data on public construction are generally obtained from government budget or expenditure accounts.

<sup>2/</sup> Estimates are made for stock changes but no information is available on coverage or method of valuation.

<sup>3/</sup> Own-account construction by large establishments only. Data on other construction are obtained from a survey of principal construction firms and tax authorities.

<sup>4/</sup> Relates to building by persons in municipalities only.

<sup>5/</sup> Expenditure data on building and construction by companies in the private sector are obtained from the annual Census of Enterprises.

<sup>6/</sup> Estimates of changes in private stocks are based on commercial bank advances. It is assumed that these advances amount to about 75 per cent of the total value of merchandise serving as collateral.

<sup>7/</sup> The expenditure method is presumably used for the clearing and development of tea, rubber and coconut estates, tea and rubber machinery produced locally and imports of buses and lorries.

<sup>8/</sup> Used primarily in estimating capital formation in private residential construction.

<sup>9/</sup> Except for unincorporated enterprises engaged in agriculture where the current price is applied.

<sup>10/</sup> Excludes depreciation in the government sector.

<sup>11/</sup> Estimates are based on returns made by architects.

<sup>12/</sup> Only military construction of permanent dwellings is included.

<sup>13/</sup> Based on the financial accounts of companies and partnerships in Bangkok and Dhonburi and on the amount of business tax collected by the Department of Revenue.

<sup>14/</sup> Only military construction of roads, bridges and buildings is included.

<sup>15/</sup> Except for changes in the number of livestock and in stocks of sugar and tobacco where an average price is applied.

deducting public capital formation from the total obtained by the commodity-flow method. In addition, a number of countries in Africa and Asia obtain expenditure data directly from large enterprises. Japan and the Republic of China use the expenditure method exclusively for estimating capital formation in machinery and equipment.

10. The principal merits of the commodity-flow method, aside from the fact that, in the absence of expenditure inquiries covering all sectors, it is the only way of arriving at an estimate of total capital formation, are that it avoids the use of accounting concepts that are apt to vary between industries and enterprises and that it makes possible a classification of capital formation by type of asset. However, the method has two serious deficiencies. The first is the practical difficulty of allocating between investment and consumption the imports and domestic production of goods with multiple uses and mixed groups of goods. The second difficulty is that of determining the amounts by which to increase the c.i.f. import values and the ex-factory values of domestically produced goods for the purpose of covering other expenses included in the final cost to the purchaser, such as customs duties, excise taxes, trade mark-ups and transport and installation costs.

(i) Allocation of mixed assets

11. Although most imports and domestic manufactures can be uniquely categorized as either capital goods, intermediate goods or consumption goods there are many with mixed uses that cannot be so classified. Examples of such goods that are likely to be important in under-developed countries are passenger cars, refrigerators, sewing machines, typewriters and electrical appliances. Some finished goods, such as small electric motors, can conceivably belong to all three categories. In addition, imported parts may be used for major alterations (to be included in capital formation), for repairs and maintenance (to be excluded from capital formation, unless the "gross-gross" concept be adopted) or as raw materials that go into the manufacture of local products (to be included in capital formation but from the production side). Some countries, on the basis of their import statistics, divide goods of mixed use into the above categories by means of some arbitrary percentages. A few countries (e.g., Philippines) base these allocation

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factors on consultations with technical experts. Most countries, however, seem to classify such goods according to their predominant use. Although the errors involved are to a certain extent compensating, this method is obviously unsatisfactory.

12. It is doubtful whether all countries employing the commodity-flow method make use of their most detailed import statistics in preparing estimates of capital formation. Of the 83 countries at present using the Standard International Trade Classification, about 70 per cent are under-developed. A number of these countries (e.g., Burma, Ceylon, India, Nigeria, Thailand, Trinidad) have a classification more detailed than the 5-digit SITC. A detailed trade classification is essential for many purposes, whether or not a country uses the SITC. It is clear that the use of the most detailed categories of imports would be invaluable for allocating certain categories of mixed capital assets. Such information as size or type of commodity would be very useful for this purpose. For example, if the trade statistics show the imports of refrigerators by capacity (e.g., cubic footage) or typewriters by kind (whether portable or standard) the statistician would have a basis for allocation. Although admittedly not perfect, this would be better than some arbitrary allocation.

13. Some items (e.g., passenger cars) may be used in further production or for consumption and import statistics would not be particularly helpful for allocation purposes. Imports of passenger cars are an important item in many under-developed countries but the methods used to estimate their contribution to investment are in most cases very arbitrary. There are certain problems peculiar to passenger cars that make a satisfactory allocation practically impossible. For example, the owner of a small business may use his car for both productive purposes or for pleasure or a firm may subsidize the use of employees' cars (e.g., travelling salesmen). Furthermore, the problem of negative capital formation is involved where a firm purchases a new car to replace a used one which it sells to an individual for non-business use. In spite of these difficulties, countries might attempt to use whatever statistics are at hand to estimate as accurately as possible the proportion of passenger car imports that contribute to capital formation. A logical approach would be to use available data on new car registrations. It may be found, however, that such data are not tabulated in a form that would be useful for this purpose.

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Other sources worth investigating would be import licences in countries that restrict the imports of new cars, insurance records (higher rates are usually charged for vehicles used for business purposes), information obtained from car dealers and household surveys.

14. Imported commodities that are used as inputs (intermediate goods) in the domestic manufacture of capital assets should be excluded, to the extent that such assets are included in capital formation from the production side. In a few countries (e.g., Thailand) domestic production is estimated on the basis of such inputs. Many countries, however, have experienced difficulties with the treatment of parts (whether for assembly, for major alterations or for minor repairs and maintenance) because their import statistics do not always show such parts separately.<sup>8/</sup> As far as parts for assembly are concerned, countries should have no difficulties in obtaining information directly from the assembly plants themselves since they are likely to be few in number and well-known. Surveys among important manufacturers of capital goods could be used to obtain data on other parts used in domestic production as well as for major alterations. Where parts are not distinguished in the import statistics from final products and where both are to be included in capital formation there is no special problem provided care is taken to avoid duplication in the estimates. It is almost impossible to make reliable estimates for parts used for minor repairs and maintenance and many countries make no attempt to exclude them. To the extent that such parts are used for repairs and maintenance of both consumer durables and capital goods, they would have to be allocated, as a first approximation, in the same proportion as the imports of the finished goods.

15. It is possible that substantial improvements could be made to estimates of capital formation in some cases if countries using the commodity-flow approach would make use of all available information on imports.<sup>9/</sup> The bulk of capital goods are in Section 7 of the SITC (machinery and equipment) and in practice it might be sufficient to have greater detail for only a few categories of key imports.

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<sup>8/</sup> The SITC does not distinguish parts shipped for assembly to make essentially complete machines from the machines themselves, but countries having important trade of this sort can subdivide SITC headings to make the distinction. The SITC suggests that other parts be classified, where possible, according to kind.

<sup>9/</sup> See Doc. E/CN.3/235.



For the purpose of identifying commodities to be included in capital formation, countries may find useful the list of capital goods based on the SITC prepared by the Working Group on Statistics of Capital Formation of the Conference of European Statisticians.<sup>10/</sup> A tentative list for circulation among Asian countries has been drawn up by the Working Group of Experts on Capital Formation of the Conference of Asian Statisticians.<sup>11/</sup>

(ii) Problems of mark-up

16. It is clear from the information available that the methods used by most under-developed countries to estimate trade mark-ups, transport costs, installation costs and miscellaneous expenses are extremely crude. In many cases arbitrary percentages are applied to the c.i.f. or ex-factory values and the range of these factors is very wide (varying from 20 per cent to over 200 per cent, depending upon the country and type of asset). Although a number of countries have made cost-analysis studies and use differential percentage mark-ups for different categories of capital goods, these percentages are kept unchanged from year to year. The majority of countries, however, use a single percentage for all kinds of goods. Even though such a figure were carefully computed as a weighted average mark-up, it would be unrealistic to suppose, because of the varying composition of goods, that it would remain constant or that it could be applied to all types of goods.

17. Since these subsidiary costs account for a sizeable portion of capital formation, countries using the commodity-flow method could improve their estimates by the use of more realistic percentage mark-ups. It is relatively easy for countries to determine from official sources the amount of customs duties and excise taxes to be added to the c.i.f. values of retained imports of capital goods. Exports of such goods are likely to be nil or negligible in most countries. In theory they should be deducted only after the import figures have been adjusted for trade mark-ups, transport and other costs. For the purpose of ascertaining the magnitude of these latter adjustments a cost-analysis study might be undertaken each year. The trade mark-ups are likely to account for the bulk of these

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<sup>10/</sup> Doc. Conf. Eur. Stats./WG.5/CF.2.

<sup>11/</sup> Op. cit., footnote 5/.

subsidiary costs and it would be preferable to estimate them separately. The average percentage mark-ups for detailed groups of goods or for individual major items can usually be obtained from typical importers and wholesalers or with the co-operation of trade associations and other organizations (such as agricultural credit agencies in the case of farm equipment) likely to be familiar with the pricing mechanism. These trade mark-ups should not, of course, be applied to the value of goods imported directly. The latter are often major items of equipment built to specification, such as ships, locomotives and power generators. The final cost of these items could be obtained by direct inquiry from the purchasers, who should be relatively easy to locate.

18. Reliable information on transport costs, installation costs and miscellaneous expenses is more difficult to compile. These costs are likely to be high for expensive major items of machinery and equipment and data concerning them could also be obtained directly from purchasers. For other goods a rough percentage mark-up based on a survey of a few user establishments would probably have to suffice. Transport costs, of course, depend not only on the size and weight of the goods but also on the mode of transport and the distance they are transported. Although difficult, countries might try to calculate, for a representative group of goods, an average mark-up for transport costs based on rates charged by typical carriers and average distances traversed. Data on miscellaneous expenses, such as legal fees and insurance premiums, would be very difficult to ascertain, except possibly for major assets. Since these are relatively minor costs their omission would not affect the over-all capital formation estimates appreciably.

19. An alternative solution to the problem of obtaining the difference between the c.i.f. values of imported capital goods and their installed costs would be to trace these goods through to their ultimate users. This would probably be feasible only for major items of machinery and equipment or at most for a selected group of other items. If a country has a programme of distribution and industrial inquiries the questionnaires sent to firms could be utilized for this purpose.

(b) Domestic production of machinery and equipment

20. In order to estimate capital formation by the commodity-flow method the values of domestically produced assets must be added to the values of net imports. These

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data must also be adjusted to include trade margins, transport costs and installation costs, and these problems as well as those of allocation are similar to those described above in connexion with imports. All under-developed countries produce some finished capital goods although the bulk of these are simple agricultural implements and possibly machinery and equipment used in important local industries such as tea, rubber, coffee and sugar. Some of the more industrialized of these countries manufacture a wide range of capital goods, such as motor vehicles assembled from imported parts, ships, certain types of machinery and electrical equipment. The production of large-scale industry seems to be covered in the capital formation estimates of most countries. Some countries make no attempt to include domestic production at all and others include only a few key items such as plows and harrows, tea and rubber machinery. In general, the production by small-scale and cottage industries is inadequately covered.

21. Data on the value of domestically produced capital goods are obtained from the results of industrial censuses and inquiries or from special surveys. The United Nations has recommended that countries making industrial inquiries seek data on the quantity and value of key products.<sup>12/</sup> About 40 under-developed countries have at the present time programmes for the collection of basic industrial statistics and the majority of these seek data on commodities produced.<sup>13/</sup> Many of these countries make the inquiries annually, some on a sample basis. However, most have cut-off points which exclude small-scale industry.

22. Countries that have programmes for the collection of industrial statistics might find it feasible to make use of these data in their estimates of capital formation. In this connexion it is important that products be detailed enough so that capital goods may be distinguished from intermediate and consumption goods. Data on small-scale production (including cottage industries and production in rural areas) can only be obtained economically by the application of sampling techniques. Countries that have established permanent sampling units should be able to design efficient area samples for the purpose of obtaining data on the

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<sup>12/</sup> See International Standards in Basic Industrial Statistics, Series M, No. 17 and Statistical Series for the Use of Less Developed Countries in Programmes of Economic and Social Development, Series M. No. 31.  
See also Doc. E/CN.3/257.

<sup>13/</sup> See Doc. E/CN.3/257/Add.1.

small-scale production of capital goods. This could be done in conjunction with the use of sampling for estimating rural own-account construction (see para. 37 below). Countries that have no programmes for the collection of industrial statistics will find the use of sampling surveys a rapid and inexpensive way of obtaining the desired data.<sup>14/</sup>

(c) Expenditure on machinery and equipment

23. The inherent difficulties of the commodity-flow method of estimating capital formation point to the desirability of obtaining expenditure data directly from the purchasers of machinery and equipment. As pointed out above, all countries use this direct approach in measuring capital formation in the public sector and a number of countries use it either exclusively for all sectors or for major segments of the private sector. There seems to be an increasing trend among countries, both under-developed and others, to use the expenditure method alone or in conjunction with the commodity-flow approach.

24. The expenditure method has the advantage of obtaining final cost figures without encountering the problem of allocation or of making estimates of trade mark-ups and other costs, both of which are subject to wide margins of error. It also makes possible a classification of capital formation by industry of use which is important for a comparative study of development by industry. On the liability side is the fact that comprehensive capital expenditure surveys are likely to be expensive and the fact that the statistician is dependent on the firms' accounting concepts and procedures which may vary between industries as well as between firms within an industry. On balance, however, it is felt that the expenditure approach is far superior, especially if it is used to measure capital formation in all sectors, including construction. Where it is used for some sectors only and the total is obtained by the commodity-flow method the residual may well contain a high relative error.

25. Although a number of countries make use of special surveys to obtain expenditure data on machinery and equipment from government enterprises and from

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<sup>14/</sup> See Studies in Methods - Industrial Censuses and Related Enquiries, Series F, No. 4, Vol. 1, Chapter XIII.

establishments in key industries. The majority base their total estimates on the commodity-flow approach. As pointed out above (para. 21), about forty under-developed countries have programmes for the collection of industrial statistics either annually or at longer intervals. Twenty-six of these countries seek data on capital expenditures by type of asset and of these about half do so on an annual basis.<sup>15/</sup> It is therefore clear that quite a number of countries do have some basis for arriving at capital formation from the expenditure side, at least for the large-scale industrial sector. It is recognized, however, that information on capital expenditures is one of the more difficult items of data to gather in industrial statistics inquiries, especially for countries with meagre statistical resources, and it is not one of the recommended items of data in the 1963 world programme of basic industrial inquiries.<sup>16/</sup> For some sectors of the economy, such as mining, utilities and transportation, where the number of enterprises is likely to be relatively small, special expenditure surveys should not be too difficult or expensive to undertake. Programmes for the collection of distribution statistics in under-developed areas are still largely non-existent and information on investments made by wholesale, retail and related service establishments for machinery and equipment would have to come from special expenditure surveys. Although data on the total stock and type of agricultural machinery and equipment are often collected in agricultural censuses, the Food and Agriculture Organization does not recommend the collection of expenditure data in its programme for the 1960 world census of agriculture.<sup>17/</sup> This is due in part to the fact that, particularly in under-developed countries, the users of such machinery and equipment are often not the owners. For ascertainment of difficult items of data sampling is often the best approach. It should be noted that in agriculture as well as in other sectors (e.g., mining, utilities) where the kind of machinery and equipment used is peculiar to the industry and may be easily identified, reasonably good estimates of capital formation may be obtained in some cases from the import side.

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<sup>15/</sup> Op. cit., footnote <sup>12/</sup>.

<sup>16/</sup> See E/CN.3/258.

<sup>17/</sup> See Program for the 1960 World Census of Agriculture, Food and Agriculture Organization, Rome, 1957.

26. Countries should therefore be encouraged to use both the expenditure and the commodity-flow approaches in preparing estimates of capital formation. The use of the two approaches in conjunction would combine the advantages of both (e.g., a classification of capital formation could be built up both by kind of asset and industry of use). In addition, they could contribute to the over-all accuracy although it may be impossible to reconcile the two results in any detail. For example, more accurate information on mark-ups could be obtained from capital expenditure surveys for use in obtaining total capital formation by the commodity-flow method. Countries using the expenditure approach may find it more economical to do so within the framework of existing programmes for the collection of industrial and distribution statistics. Where special expenditure surveys are used to collect data from large-scale industries or key sectors the use of sampling methods should be attempted for the non-covered areas.

(d) Building and construction

27. Construction activities (including the erection of residential and non-residential buildings and the construction of roads, bridges, canals, harbours, dams, etc.) are extremely important in the economies of under-developed countries. In the great majority of these countries expenditures for construction account for more than half of gross fixed capital formation. It is apparent, therefore, that errors made in estimating expenditures in this sector may appreciably affect the over-all reliability of capital formation estimates.

28. The nature of the construction industry makes it difficult to obtain data directly from contractors and many countries find it necessary, for example, to exclude construction entirely from their industrial inquiries. Construction activities are often carried out by small contractors who are highly mobile and thus difficult to locate. Information on the value of construction completed during the year may even be difficult to obtain from large construction firms since part of the work may be let out to sub-contractors. In addition, a great deal of own-account construction is normally carried out in countries by business firms and also by individuals, particularly in rural areas. Information on the value of this latter type of construction would be practically impossible to obtain except by the application of sampling techniques. Under-developed countries therefore generally attempt to measure capital formation in construction by

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indirect means, basing their estimates either on building permits or other records (e.g., building starts or completions) or on the inputs of raw materials (or labour). The synoptic table above shows that most countries use the former method. As in the case of machinery and equipment, the value of construction in the public sector is usually obtained directly from government expenditure accounts.

(i) Use of building permits

29. This method has a number of serious shortcomings which, although recognized by countries, are seldom completely overcome. In the first place, in those countries where building permit statistics do exist they are usually available for the capital city only, or at most for a number of municipalities. Many countries simply apply an arbitrary percentage to the permit valuation figures to obtain an estimate of the value of construction in the non-covered areas. This percentage is often unchanged from year to year. Secondly, building permits, though issued, may never be used or a considerable time-lag may occur before construction is completed. Thirdly, the valuation figures appearing on building permits are themselves estimates of construction costs and may differ appreciably from the actual costs. Few countries seem to have a system of follow-up to correct for these last two deficiencies. Finally, the permit figures may include the value of land which, in theory, should be excluded.

30. It would therefore be desirable for countries to test the reliability of permit figures by means of periodic follow-ups. By means of such studies the misstated figures for the areas covered by permits may be adjusted accordingly. It is unrealistic to assume that the value of construction in cities and towns where permits are not used bears a constant relationship to those for which such data are available. Countries might attempt to get whatever information is available in those areas from local authorities, building contractors, architects, etc. Expenditures for construction made by local establishments could possibly be obtained through direct inquiries. It would, of course, be desirable if countries would eventually extend their system of building permits to cover all urban areas. The only feasible way of estimating the value of construction in the rural areas (including rural own-account construction) is by means of sampling.

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(ii) Method of material inputs

31. A number of countries base their estimates of capital formation on the value of principal raw materials consumed in construction. These may range from a single commodity, such as cement in the case of a few African countries, to a long list of imported and locally produced materials (e.g., Burma). The use of material inputs is essentially the commodity-flow approach and the same difficulties are encountered here as in the case of machinery and equipment. Thus, the materials used in construction must first be properly identified and separated out. To the value of net imports and domestic production of these materials must be added import duties, trade mark-ups, transport and miscellaneous costs. To arrive at the value of materials actually used up in construction there are the additional difficulties of making allowances for stock changes, materials used for normal repairs and maintenance and materials used for purposes other than construction. It is frequently difficult for countries to solve all these problems adequately. Once the values of these inputs have been estimated they must be multiplied by grossing-up factors to allow for other construction costs such as labour and profits. These factors are either quite arbitrary or they are obtained from a representative sample of building costs.

32. Considering the difficulties, it would seem that the input method could not give very reliable results of construction costs in a country. Furthermore, the sole use of this method would not make possible a classification of construction by type (e.g., residential building, non-residential building and other construction) or by purchaser (e.g., government or private), as is the case where building permits are used. It should also be noted that it would not cover own-account rural construction except to the extent that imported or locally produced construction materials are used (e.g., metal sheets used as roofing for native huts).

33. Where the use of this method is the only alternative, countries could effect some improvements in their estimates by basing them on a more representative list of construction materials and by working up differential mark-ups for the materials. This could be done by means of inquiries addressed to wholesalers, importers and construction firms. Adjustments for stock changes and for materials not used directly in construction could probably be ascertained only very roughly, except

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perhaps for a few key commodities. An attempt should be made to arrive at weighted average grossing-up factors based on the ratios of final construction values to costs of material inputs for typical kinds of construction. These technological ratios might be obtained from contractors or engineering firms. Care must be taken to avoid duplication in the final results. For example, some types of machinery and equipment, such as power generators and radio and telephone equipment, are sometimes installed as integral parts of buildings and should therefore be excluded from imports if the commodity-flow approach is used.

(iii) Expenditure method

34. Capital formation in construction could be measured and classified more accurately if estimates were made directly from the expenditure side. Most countries do this for general government and government enterprises since data are generally available from budget statements or expenditure accounts. If total capital formation in construction is estimated either by the building permit or input method, capital formation in the private sector is obtained as a residual. Assuming the accuracy of the government expenditure figures, the total error would be concentrated in this residual. For this reason a few countries (e.g., Ghana and former French West Africa) use the expenditure approach in conjunction with other methods to obtain better estimates for the private sector.

35. In view of the practical difficulties connected with the building permit and input methods, countries might try to obtain direct information on construction expenditures in the private sector. This should be feasible at least for large enterprises. Such information should include both construction work done for the enterprises by outside contractors and own-account construction. The coverage of the latter item might vary between firms depending upon whether it is treated as a capital expenditure and whether it includes an imputed value for labour and other costs. Countries that use this approach for construction could at the same time seek data on expenditures made for machinery and equipment. East Africa, for example, adopted the expenditure approach precisely because of the difficulties encountered in estimating by other means the construction expenditures of companies with large investment projects. The opportunity was then taken of asking for other

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expenditure figures at the same time. This would not solve the problem of private residential building, however. Estimates of such construction in urban and rural areas would still have to be obtained on the basis of building permits, inputs of construction materials or sampling, or a combination of these methods.

(iv) Agricultural improvements, own-account rural construction and military construction

36. Although direct investment in agriculture by large plantation companies is generally included in the capital formation estimates of under-developed countries, the establishment, extension and improvement of small agricultural holdings carried out by farmers themselves seems to be omitted in most cases. This omission is serious in the case of under-developed countries where peasant agriculture is particularly important. In spite of the conceptual and statistical difficulties involved, an attempt to measure such capital formation would therefore be desirable. The use of agricultural sampling surveys would be especially appropriate for this purpose.

37. Other building activities carried on with unpaid labour, such as dwelling units in rural areas, though small individually, are likely to be sizeable in the aggregate. Although details are not available for most countries, it is known that a few do make estimates of such construction either by the use of sampling or by the addition of a flat amount to the value of other construction. Rather than exclude this type of construction entirely or include it by means of an arbitrary figure, countries might attempt to estimate it on the basis of efficiently-designed area samples. This should be comparatively easy for countries that have established permanent multi-purpose sampling units. It would be useful if countries would show these estimates of rural own-account construction separately from other types of construction.

38. Information on the treatment of military expenditures is available for only a few countries. However, it is believed that, with the possible exception of military construction for civilian use (e.g., permanent dwellings or hospitals used for both military and civilian patients), such expenditures are excluded from capital formation estimates in accordance with international recommendations on the subject.

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(e) Classification of capital formation estimates

39. Estimates of capital formation are of course more useful for purposes of economic analysis if they are classified or cross-classified by type of purchaser, kind of asset and industrial use. The extent to which this is done varies considerably among countries, depending upon the approach used in preparing the estimates and the amount of detail in their basic statistics.

40. As shown in the synoptic table, all countries are able to make a distinction between public and private capital formation. This is so because estimates for the public sector are obtained directly from government expenditure accounts while those for the private sector are obtained as a residual. It should be noted, however, that many countries have experienced difficulties in obtaining data on capital expenditures made by local governments. Some countries make a further distinction between general government and public enterprises. The break-down of capital formation between the public and private sectors is particularly important in these countries because of the expanding role of government in their development efforts.

41. Nearly all countries are able to classify their estimates by type of asset since they are arrived at by use of the commodity-flow method. The classification may be a broad one (e.g., construction, transport equipment, and machinery and equipment) or quite detailed, depending upon the nature of the import statistics and the needs of the country. Some countries break down construction into building and other construction and a few publish separate estimates for residential and non-residential building. The latter break-down is particularly useful because of the importance of new housing in social development schemes.

42. Almost half of the countries surveyed also classify capital formation by broad industry of use (e.g., agriculture, mining, manufacturing, etc.), although the degree of detail varies. This type of classification is well adapted to countries that use the direct expenditure approach either exclusively or for obtaining better estimates of capital formation in certain industries. Countries that use only the commodity-flow approach would find it difficult to classify capital formation by industrial use except possibly when their import and production statistics are available in detailed form. Typical kinds of machinery and equipment are often used in certain industries (e.g., agriculture or mining) and these could be separated out from other imports and local products.

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(f) Estimates of capital formation in constant prices

43. The value of capital formation estimates is considerably enhanced when they are properly adjusted for fluctuations that occur in the prices paid for capital goods. The resultant figures then become useful as an index of the physical investment made within a country from year to year. In spite of the statistical difficulties involved, about half of the countries do make estimates of capital formation in real terms. While details on the methods used are not available, it is believed that only the total capital formation figures are deflated, possibly by means of specially constructed price indexes.

(g) Stock changes and depreciation allowances

44. Since this paper is limited to a discussion of gross fixed domestic capital formation, only brief reference is made to the question of estimating stock changes and capital consumption.

45. Inventories are a source of some of the most difficult accounting problems, both theoretical and practical. For this reason reliable figures on stock changes are difficult to come by, even in countries with developed statistical systems. Since most under-developed countries use the commodity-flow approach in preparing estimates of capital formation, their final figures already include changes in the stocks of capital goods in the hands of importers, wholesalers and manufacturers. It is therefore apparent that some idea of the magnitude of stock changes must be had in order to make estimates of gross fixed capital formation. Changes in stocks of raw materials must also be taken into account where the input method is used as a basis for estimating capital formation in construction.

46. Although details on methods used are lacking in most cases, many under-developed countries do make estimates of stock changes. In about half of the countries surveyed these are based on a few key export commodities such as sugar, rubber and tin. Information on the stocks of such goods are comparatively easy to obtain but it may be dangerous to assume that stocks of the excluded items move in the same way. Where the expenditure approach is employed, data on stock changes are needed to obtain an estimate of total gross capital formation. In both the

Republic of China and Japan, where this method is used, rather complete data on stock changes are obtained by the use of sampling methods. It appears that stocks are valued in most cases at book value. In a few cases where partial estimates are made the figures relate to the value of the physical change of stocks.

47. It is important to have reliable information on net fixed capital formation in order to know to what extent a country's capital resources are being enlarged. This is especially true for countries in the process of development where capital consumption is likely to be relatively high due to lower standards of maintenance, unavailability of repair parts when needed, unfavourable climatic conditions and poor roads. As in the case of stock changes, however, there are formidable conceptual and statistical problems connected with the measurement of depreciation.

48. Of the countries shown in the synoptic table all but six make allowances for depreciation although details on methods are lacking in most cases. Only two countries base their estimates on replacement cost while the remainder presumably use original cost as the basis for valuation. Considering the many practical difficulties involved, the paucity of basic statistics and the fact that most under-developed countries do not use the direct expenditure approach in measuring capital formation, it is doubtful whether these allowances can be determined with any degree of accuracy.

## VI. SUMMARY AND CONCLUSIONS

49. Any study of the methods used for measuring capital formation leaves the impression that these statistics in general are not very reliable. This remark applies with special force to building and construction activity and is by no means confined to countries at an early stage of development. Capital formation statistics are of paramount importance to developing countries and a determined effort should be made to improve them. Some improvements can be effected with little additional application but in the main more statistical resources must be applied to the task. One cardinal principle should be recognized: ingenuity in estimation based on bits and scraps of information is no substitute for genuine statistical inquiry, whether complete, quasi-complete or on a sample basis.

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50. The quality of capital formation statistics could be improved substantially if under-developed countries would take steps to use:

- (a) more realistic allocation and mark-up percentages for imports and locally produced goods. These factors should be based on cost analysis studies and on a use of the most detailed information available on imports (paras. 11-22)
- (b) follow-up studies to adjust the value of construction figures obtained from building permits (paras. 29-30)
- (c) technological ratios based on a study of typical building costs, where the material input method is employed (paras. 31-33)
- (d) the direct expenditure approach, wherever possible, in conjunction with the commodity-flow method (paras. 23-26, 34-35)
- (e) sampling methods to obtain estimates of capital formation, particularly in small-scale industry, rural construction and agriculture (paras. 25, 36-37).

51. The above proposals are also taken up in detail in the Report of the Working Group of Experts on Capital Formation of the Conference of Asian Statisticians. In addition, the Expert Group recommends that a working group be convened to consider methods of estimating national income in the ECAFE region, followed by a similar group to consider the conceptual and practical problems involved in estimating capital consumption. The Expert Group also recommends that the United Nations provide technical assistance in the field of capital formation statistics to countries requesting such assistance. In view of the importance of effecting a more rapid improvement in the capital formation estimates of under-developed countries the Statistical Commission may wish to comment on these various proposals.

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