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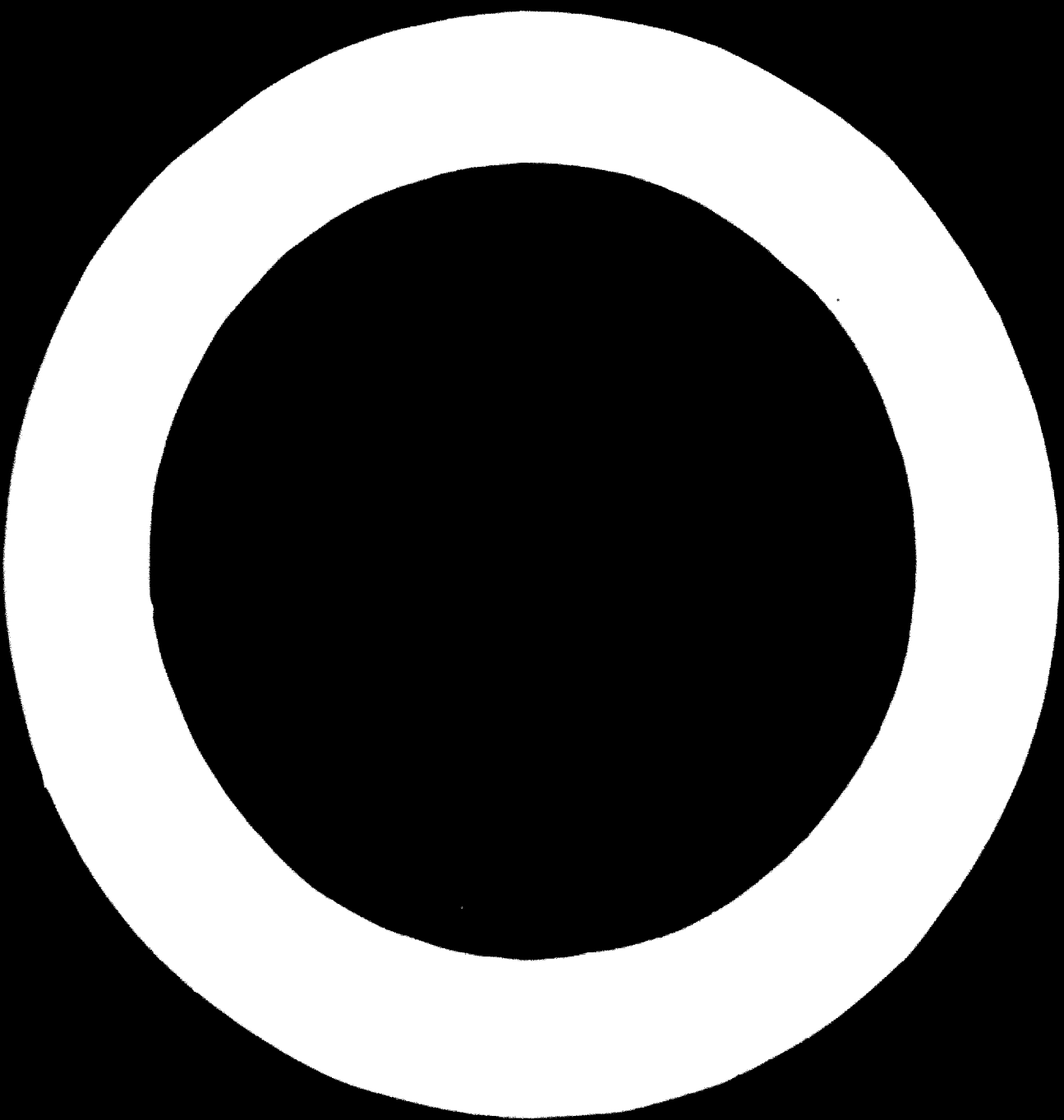
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CONSTRUCTION INDUSTRIES

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SECTORAL STUDIES PREPARED FOR THE SYMPOSIUM:
CONSTRUCTION INDUSTRIES 1/

Prepared by the United Nations Centre for Housing, Building and Planning

Presented by the Executive Director of the United Nations
Industrial Development Organization

1/ A related sectoral study, "Building Materials Industries, including Wood Products", prepared by the secretariat of the Economic Commission for Europe on the basis of studies by a group of consultants, is presented to the symposium as ID/CONF.1/23.

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CONTENTS

	<u>Paragraphs</u>
Introduction	1
Definition of "construction" and "industrialization of construction"	2
Relationship of the construction industry to other branches of industry and to the national economy	3 - 10
Special characteristics of the construction industry	11 - 20
Development of the construction industry and the particular role of Government	21 - 27
The process of industrialization in construction	28 - 39
Design, standardization and use of mathematical methods and computers	40 - 47
Research, development and technical information	48 - 53
Education and training for the construction industry	54 - 56
Recommendations	57 - 74

ANNEXES

	<u>ANNEX PAGE</u>
I. LIST OF DOCUMENTARY REFERENCES	1
II. TABLES, GRAPHS AND FIGURES	1
Table A: Major economic indicators in construction, 1955-1963	1
Table B: Indices of employment in construction in selected African countries, 1958-1963	6
Table C: Development of size of building firms	7
Table D: Average size of building enterprises in Eastern European countries	8
Table E: Concentration of building production	8
Graph A: Relationship between annual rate of growth of <u>per capita</u> GDP and share of construction in gross domestic fixed capital formation, 1960-1963	
Graph B: Relationship between annual rate of growth of <u>per capita</u> GDP and share of construction in gross domestic fixed capital formation, 1955-1963	

CONTENTS (continued)

Graph C: Relationship between annual rates of growth of value added by construction and GDP at factor cost, 1955-1963

Figure A: Scheme of the economic components of total construction output

Introduction

1. Population growth, raising the standard of living and general industrial development impose growing demands on the capacity and efficiency of the construction industry. As a country begins or continues to develop, there is an increasing need for industrial and power projects, housing, community and transport facilities etc. However, in most countries, particularly developing countries, the disparity between construction needs and construction capacity is wide, and this greatly impedes general industrial development and achievement of the country's economic and social goals. Economic and social aims cannot be accomplished unless supported by a construction industry capable of meeting the demands they impose upon it. For this reason, development of the construction industry deserves the concentrated attention of Governments over a prolonged period.

Definition of "construction" and "industrialization of construction"

2. The major national economic statistics currently available can be used only with considerable caution in making international comparisons. It is difficult to obtain figures from various countries that can reasonably be compared. The definition of "construction industry" used in this paper is the one provided in the International Standard Industrial Classification of all Economic Activities (ISIC), as follows:

Construction, repair and demolition of buildings, highways, streets and culverts; heavy construction of such projects as sewers and water mains, railway roadbeds, railroads, piers, tunnels, subways, elevated highways, bridges, viaducts, dams, drainage projects, sanitation projects, hydroelectric plants, water power projects, gas mains, pipelines, and all other types of heavy construction; marine construction such as dredging, underwater rock removal, pile driving, land draining and reclamation, construction of harbours and waterways; water wells; airports; athletic fields, golf courses; swimming pools; tennis courts; parking areas, communication systems such as telephone and telegraph lines; and all other construction, whether undertaken by private bodies or government authorities. Special trade contractors in the field of construction, such as carpenters, plumbers, plasterers and electricians, are also included in this group.

This division does not include construction, repair and demolition work undertaken as an ancillary activity by the staff and for the use of an

establishment classified in any other division of the classification. Excavating, overburden removal, shaft sinking and dredging, when undertaken in connexion with mining, are classified in the appropriate group of division 1 (mining and quarrying). 2/

The term "industrialization of construction" is used in this paper to describe the entire process of technical and organisational development of the construction industry, from the simplest handicraft methods to the most industrially advanced. The most important stages in development comprise rationalization, mechanisation and assembly of factory-made elements.

Relationship of construction industry to other branches of industry and to the national economy 3/

3. In all countries, construction is one of the largest sectors of economic activity, second only to agriculture in developing countries and to manufacturing in the industrialized countries. Its value in relation to the gross domestic or net material product in the early 1960's ranged between 2 and 10 per cent in various countries, with an average value of more than 5 per cent, and was generally higher for developed countries (nearly 6 per cent) than for developing ones (just over 3 per cent). The fact that developed countries contribute more than five sixths of the total gross domestic product further aggravates the inequality of distribution of construction activity in the world. In fact, nine tenths of the value added by construction in the world is contributed by developed countries. The share of national resources devoted to construction does not appear to bear a direct relationship to the general level of economic development; countries with approximately the same per capita gross domestic product direct a varying percentage of their income to investment in construction. The share of construction in gross domestic fixed capital formation is not related either to the rate of growth or to the real gross domestic product. It can only be concluded that construction activity appears to grow fairly steadily with general economic growth, i.e. the higher the per capita gross domestic product (GDP) the higher the expenditure in construction. A large number of factors affect the actual

2/ Ref. No. 1 (p. 26, para. 3.1 of document).

3/ Ref. Nos. 2, 3, 4; see also table A in annex II.

amount devoted to construction by a given country at a given stage of economic development, and account for the wide differences observed between countries, both developed and developing.

4. The construction industry, as measured by the value of new work and major capital repairs, accounts for more than half of the gross domestic fixed capital formation in practically all countries, whatever their level of economic development.^{4/} For more than half of the countries for which data are available on a comparable basis, construction has represented between 55 and 70 per cent of gross domestic fixed capital formation in the past decade. For most developing countries, past levels of investment therefore constitute a primary condition for accelerated growth.

5. There is an understandable tendency for countries formulating long-term development plans to place emphasis on the growth of consumer goods industries for whose products there is a substantial demand and which, unlike construction, do not depend heavily on inputs from manufacturing industries. At the same time, the creation of new industries or the expansion and diversification of agricultural production, which are among the immediate objectives of most economic development plans in developing countries, require a substantial contribution from the construction sector. It would be erroneous to overlook this relationship and to plan development of the national economy without fully appreciating its connexion with the construction industry.

6. The few input-output data available for developing countries, and even the more extensive data on selected industrialized countries, provide only a rough indication of the structure of the construction industry in relation to other sectors. In most cases, all construction is lumped together in a single category without distinguishing between new work and maintenance and repairs, or between construction of different types. Even in their crude form, however, those data show that the relationship of "inputs" to "value added" in construction is not greatly different from that of the goods-producing industries. The value added by construction accounts for between 35 and 50 per cent of gross output.^{5/}

^{4/} See graphs A and B (in annex II).

^{5/} Ref. No. 6 and figure A (annex II).

7. Construction as a major economic activity depends heavily for its inputs on the outputs of a large number of other industrial sectors, ranging between 50 and 55 per cent in different countries. Generally, the higher percentage applies in developing countries, probably because of the relatively higher prices of imported materials. The differences in the methods used for segregating the gross domestic product of individual countries prevent valid comparisons to be drawn on an international basis. By and large, however, construction uses a significant share of the outputs of a number of other industrial sectors, such as, for instance, heating, plumbing and electrical equipment, structural metal products, stone and clay products, timber and other wood products, paints and allied products, materials handling machinery etc. This is shown clearly in the following tables.

Table 1
Input-output analysis of the construction industry, Tunisia, 1957^{6/}

Purchase from other sectors	Value Thousand dinars	%
Mining and quarrying	696	4.4
Wood products	788	5.0
Chemicals	1,006	6.4
Petrochemicals and coal	337	2.1
Non-metallic minerals	2,085	13.3
Metal products	947	6.0
Electricity, gas and water	290	1.8
Trade, banking and insurance	2,574	16.4
Total inputs^{2/}	8,723	55.6
Subsidies	(-172)	(-1.1)
Wages	3,382	21.6
Social security	640	4.1
Amortization	620	3.9
Operating profits	2,499	15.9
Total value added	6,969	44.4
Total gross output	15,692	100.0

^{2/} Of which, 2,098 were for imports.

^{6/} Ref. No. 5.

Table 2

Input-output analysis of the construction industry, Zambia, 1961.^{1/}

£ million at current prices

	Value	%
Imports	4.6	23.2
Import duties	0.2	1.0
Transport	0.5	2.5
Distribution	1.3	6.5
Other	4.6	23.2
Total inputs	11.2	56.5
Employee's income:		
Non-African	3.6	18.2
African	3.7	18.7
Direct tax	0.1	-
Mixed type of income:		
Non-African	0.4	0.2
African	0.4	0.2
Proper / income payments abroad	0.1	-
Savings and depreciation	0.3	1.5
Total value added	8.6	43.5
Total gross output	19.8	100.0

^{1/} Ibid.

The pattern is likely to differ from country to country, depending on the level of building technology, the availability of locally manufactured industrial products and the relative importance of construction in the national economy. The quality, smooth supply and technical standard of these other industrial sectors considerably influence the quality, labour productivity and economy of construction. The realization of construction programmes therefore, is not solely an internal problem of the industry, but must be ensured through appropriate action in other economic branches or through imports.^{8/}

8. Construction is a great consumer of manpower. In the majority of countries at different levels of economic development, employment in construction accounts for 6 to 9 per cent of total employment. To this should be added the labour employed in the manufacture and transport of building materials and components, in the production and servicing of building plant and machinery, and in the professions connected with the construction process. In the absence of better estimates, it is not unreasonable to assume that the total labour force directly or indirectly concerned in construction can amount in certain cases to one fifth of the total labour force.

9. If the value added by construction per capita (of construction workers) is taken as a crude indicator of productivity, the information available shows that in the majority of countries, the productivity of construction has increased in the past decade, although the apparent rate of increase has generally been lower than that of industry as a whole, with a few notable exceptions. On the other hand, the comparison between the share of construction in gross domestic product and the share of construction in employment appear to confirm that in the majority of countries, the net output per person employed in construction is slightly lower than the national average, and considerably lower than that of manufacturing industries.

10. It is apparent that few economic development plans give separate consideration to construction as an industry by itself. In some cases, construction is

^{8/} For further details, see a report on "Development of the Building Materials and Components Sector", chapters I and II, under preparation for the United Nations Committee on Housing, Building and Planning.

amalgamated with other goods-producing industries; in others, it is considered only indirectly, as a vehicle for capital formation or the provision of communal facilities and services (housing, schools, hospitals etc.). In other words, construction is often considered merely as a service to other industries or as an instrument for achieving specific social targets, and is not assigned physical or economic targets of its own. As a consequence, the industry is placed in an especially unfavourable position in formulating medium- or long-term plans for its own development.

Special characteristics of the construction industry

11. All who are concerned with industrial development of construction must keep in mind that it has certain special characteristics, which set it apart from the majority of other industrial branches. Some of these characteristics contribute to its lagging behind general industrial development.
12. From an analysis of construction output, it is apparent that in most countries, sustained growth of construction is related to a generally high level of economic development, and that a substantial year-to-year fluctuation in construction output is generally found in countries with a lower per capita gross domestic product. Analysis also shows the exceptional sensitivity of construction to general economic policies, which affect both long-term planning and investment. This is understandable in view of the industry's substantial contribution to investment and its dependence on government policies.^{2/}
13. The preponderance of the public, or publicly controlled, sector in total construction output is also at the root of some of the fluctuations in construction activity observed in the past decade. Governments are naturally tempted to use construction as an indirect regulator of the economy. They may do this not only through construction programmes for which they are directly responsible, but also through financial and fiscal policies aimed at modifying the structure of incomes and the pattern of private savings. This has been the case in many industrialized countries in the recent past. It still is the case in the less

^{2/} See graph C (annex II).

industrialized countries of Europe and is even more common in other developing countries.^{10/} Experience shows, however, that the construction industry responds rather slowly to stop-and-go policies, especially in the more developed economies. This is due to one fundamental characteristic of the construction process, namely, that it is a comparatively long process involving a wide range of professional skills at all levels, that it is regulated by complicated administrative and financial measures and that it is dependent on carefully worked out programmes for phasing its various stages.

14. Construction employs a comparatively high proportion of semi-skilled and unskilled labour, especially in developing countries. In the early stages of industrialization, the construction industry has traditionally played a role of transitional employment for generally unskilled labour moving from rural areas to major urban centres. This movement of population has taken place within developed and developing countries and even between one country and another. Construction therefore plays an important role as a transition stage between employment in agriculture and employment in the manufacturing industries. However, this means that in the majority of countries, both developed and less developed, construction faces particular manpower problems. The most important of these are a high turnover of manual labour and a generally low level of skills.

15. The conflicting requirements of a rapid expansion of construction as one of the conditions underlying economic development and the need to create employment opportunities for large sectors of the population have raised serious problems for most developing countries, and the contribution that industrialization can make to direct employment opportunities is beginning to be appreciated by those countries. It may be reasonable for an individual country to employ capital-intensive methods for one programme, and labour-intensive methods for another programme undertaken at the same time. The productivity of manual labour is so low in many developing countries that, in spite of extremely low wages and the relatively high cost of imported equipment, capital-intensive methods of construction are often economically sound, if not socially desirable. Furthermore, the need to organize the large number of unskilled workers that labour-intensive techniques

^{10/} See table B in annex II and Ref. No. 5.

require in major construction schemes often puts a heavier strain on scarce skilled supervisors than does the use of an elaborate plant and machinery.

16. Unemployment in construction, where it exists, varies considerably from year to year and from country to country; but in the majority of countries for which comparative figures are available, construction appears to have a higher than average incidence of unemployment, due mainly to seasonal fluctuations that are higher than in any other sector.^{11/}

17. Construction is marked by the duality which characterizes under-development. In most developing countries, two separate sectors coexist in so far as construction is concerned: (a) the traditional activity concerned with creating and maintaining structures and services in the rural areas and on the urban fringe; and (b) the modern sector oriented towards the construction of major infra-structural projects or the provision of comparatively elaborate buildings in the urban areas. The first sector belongs almost entirely to the non-monetary category of the economy, while the modern sector is marked by the techniques and organizational methods of the industrialized countries. Depending on the stage of development of economy, an intermediate sector can play a role of varying importance. This is represented by the small- to medium-size building firms able to cope with projects of not too great a complexity, and almost exclusively using local skills and, whenever available, local building materials. It is towards the development and enlargement of this intermediate sector that attention should be mainly directed by developing countries. Even in developed countries where there are large and technically competent firms capable of carrying out complex construction projects, a large part of the total volume of construction is still undertaken by small firms of the type mentioned.^{12/}

18. There is also an enormous gap between the experienced approach of the government departments that have traditionally been concerned with the provision of public buildings and civil engineering works, on the one hand, and the simple but comparatively effective techniques used by local craftsmen and self-employed builders, on the other. This gap is partly due to the acute shortage of highly

^{11/} Ref. No. 7.

^{12/} See tables C, D and E (annex II), and Ref. No. 5.

skilled personnel. Without such personnel, the "formal" approach to construction (detailed designs, comprehensive specifications, public tendering, continued supervision of site operations etc.) cannot be used to meet the requirements of a constantly expanding demand for buildings and construction of all kinds. Since that approach is ill-adapted to the specific needs of developing countries, it can result in poor quality of construction, unnecessary delays and, in the end, high building costs. The failure of many well-intentioned programmes to provide "low-cost" housing demonstrates the fallacy of such an approach.

19. It is important to note, however, that the "technological gap" between the construction industries in the most industrialized and in the least developed countries is probably smaller than the technological gap between the same countries in relation to most other industries or agriculture. But while the industrialized countries are wholly - or almost entirely - self-sufficient in regard to building materials and components, building plant and fuel, many developing countries are heavily dependent on imports of such basic commodities. The success of many economic development plans, formulated or in the course of implementation, in developing countries is therefore linked to, if not conditioned by, the rapid development of local production of building materials and components, and a better utilization of scarce building plant and equipment.^{13/}

20. A fundamental difference between the construction industry and other industries - a difference that is not always appreciated fully - concerns the important effects of construction on the human environment. Every new building, and most construction work, not only has an effect on the national economy but also helps to shape the environment in which people live. Sometimes, therefore, those functional qualities of buildings that affect health and cultural life should be given greater consideration, in the long term, in a country's development plans. Since a building or construction work usually has a long life in comparison with the products of other industries, the environmental factor relating to the construction industry deserves even greater respect than it has received. The

^{13/} For more detailed information, see chapter I, table 4, of "Development of the Building Materials and Components Sector", under preparation for the United Nations Committee on Housing, Building and Planning.

fact that the final product has more than a purely economic significance is reflected in several organizational characteristics. In contrast to the situation in most industries, construction design is undertaken by firms entirely separate from the firms that carry out the construction work. Furthermore, control over construction activities is exercised by central and local government authorities to a far greater extent than in the case of other industries. The interdependence of the preparation of a construction programme and regional and town planning must always be borne in mind. The influence of physical planning on the final value of construction work is a feature of construction which must not be neglected.

Development of the construction industry and the particular role of Government

21. The actual form of State activity in the construction field varies widely among countries, even in the case of countries that are close both geographically and in respect of their economic systems. Government participation in construction and related activities covers some or all of the following areas:

- (a) Physical planning, usually controlled by municipal or district building authorities, through zoning plans, building standards and issue of building permits.
- (b) Financing, either through public investment (including State-subsidized or public housing) or through encouragement to private investment.
- (c) Building design and, in some cases, construction of public projects.
- (d) In some cases, arranging the production of building materials and components.
- (e) Development of building industry and industrialized methods of construction.
- (f) Fostering technical development, research, exchange of information and personnel training.

In most developing countries, construction work carried out for the Government by government agencies - generally public works departments or specialized government undertakings concerned with the development of infra-structure - serves an invaluable instrument for modernization of the construction sector and for introduction of comparatively modern contractual procedures, advanced building techniques, and new plant and machinery.

22. As stated in paragraph 12, the building industry (particularly in developing countries) reacts sensitively to all economic and political changes by an increase or reduction in its activities. Both the volume and type of construction will vary, with the result that individual building firms must recruit or dismiss labour.^{14/}

Another reason for the observed fluctuation in construction volume in developing countries is the relative importance of major infra-structural or industrial development, consisting of a limited number of very large projects of the non-repetitive type (dams, harbours, airports, trunk roads, irrigation schemes, power transmission, engineering plants etc.). Unless long-term plans are formulated for the construction industry as a whole, such large fluctuations will continue to be a deterrent to its rationalization, especially with regard to long-term training programmes and plans for investment in plant and machinery.^{15/}

23. The absence of long-term investment policies, the inadequacy of construction programmes and the discontinuity of demand are perhaps the most significant factors limiting the application of industrialized methods in developing countries. These factors exert an unfavourable influence on the development of labour productivity and of the capacity of building corporations, as well as of construction costs, and generally retard the industrialization of construction. It is important, therefore, to create a climate conducive to development of the construction industry by ensuring a constant increase in the requirements imposed on the industry, in accordance with the long-term needs for development of the national economy.

24. Placing long-term orders with corporations that have the potential for developing new techniques and that are willing to make efforts to reduce the construction period and the costs, may lead to improvements in labour productivity and the use of more efficient methods.

25. Development of the construction industry is often retarded or prevented by obsolete laws and regulations, or by lack of any laws. Their revision or the issue of new, modern regulations can greatly benefit the industry. A suitable adjustment, where necessary, to the laws governing acquisition of land for construction may also have a substantial beneficial effect.^{16/}

^{14/} See table B in annex II.

^{15/} Ref. No. 5.

^{16/} Ref. No. 8.

26. Collection and prompt dissemination of accurate information on the financial and physical features of construction activity will constitute an important step in assisting development. Present-day statistical and accounting methods greatly facilitate the preparation of national construction statistics. It is usually necessary to persuade individual firms of the importance of this effort; to help them to supply accurate basic statistical data, and to show how such information may be used to formulate plans for the future work and development of these firms. Establishment of indices for various aspects of the industry, designed to show annual progress clearly, will usually make them more readily understandable and facilitate their use. It is also important to help individual firms realize that maintenance of statistical records of their own operations can be of great value in planning their own development.

27. From the foregoing, it can be seen that the role played by central government, local government and public undertakings in the over-all construction programme is of great importance. This role is especially marked in some countries, depending on their state of development and their economic system. Where the direct responsibility of Government and other public bodies is comparatively less dominant, Government policies nevertheless influence, directly or indirectly, a large part of the output of the construction industry.

The process of industrialization in construction

28. In the course of a change-over from handicraft forms of production to industrial forms, the construction industry, like other industrial branches, takes advantage in all cases where repetition of similar or analogous production processes exists, to introduce specialization and thus create the basis for the eventual introduction of mass production methods. A higher concentration of specialized operations makes it possible to use more effective equipment and gradually to replace manual labour by a more efficient machine operation. At the same time, this also sets the stage for the transfer to permanent workshops of all processes which need not be carried out on site. A peculiar feature of the building industry is, of course, that some of its processes cannot be transferred to workshops but must always be carried out on site. In the process of industrialization, however, even the operations which must be performed on site are progressively mechanized. One important result of

industrialization is the increased demand on management to develop new processes in organizing the work. Standardization, the flow-line method of construction, methods of operational research and computers are used on an ever-increasing scale.

29. Industrialization of construction began to develop on a large scale after the Second World War, when the resources of manpower were exhausted in many developed countries and the capacity of the industry was not sufficient to meet the demands imposed on it. The following table shows the progress in industrialization made in Czechoslovakia during the period 1957 to 1965.

30. In developing countries, conditions for the introduction of industrialized methods of construction are not always favourable. The most serious obstacles are a surplus of manpower, a shortage of technically skilled personnel and discontinuity in demand.

31. The scope for development of the construction and building materials industries varies considerably from one country to another. Countries which are only beginning their industrial development are usually more interested in securing the required quantity of basic building materials and they continue to use simple methods of construction. Countries which are at a higher level of economic development and which have established a certain basic building materials industry are more likely to concentrate on enlarging its capacity and improving its quality. The methods of construction employed are also likely to be more advanced.

32. Development of the building industry towards full industrialization should be achieved gradually in the following stages:

- (a) Improved handicraft methods of masonry and concreting, using traditional materials and equipment.
- (b) Rationalization of handicraft operations, supplemented by prefabrication of some building components on site, using traditional materials and simple assembly methods and equipment.
- (c) Assembly of buildings from factory-made components, mostly of reinforced concrete.
- (d) Assembly of buildings from factory-made components of reinforced concrete, metals and plastics.

It is important to realize that the more developed countries are likely to have the first three, or all four, of these stages exist in their construction industry at the same time (see table 3, on Czechoslovakia, above). On occasion, instead of proceeding gradually, a country has introduced advanced methods of industrialized building for which it was neither economically nor technically prepared and, as might be expected, difficulties have resulted.

33. The industrial development of construction is closely connected with the development of production of building materials and components. Control of investment policy in that industry by means of long-term development plans can greatly facilitate industrialization of construction. With increasing

industrialization, greater demands are imposed on a country's financial and technical resources and on its skilled personnel. The construction industry in highly developed countries can obtain assistance from other industrial branches to further its development, to supply machinery, personnel, training, etc. Developing countries, however, must introduce industrialized methods with due regard to their limitations. It is necessary to consider particularly:

- (a) The amount of capital available for investment in a contractor's plant and precasting works.
- (b) The question whether a sufficient continuity of building activity to maintain the plant in full production is ensured.
- (c) The merits of importing plant and materials, as compared with their manufacture by the national industry.
- (d) The standard of technical personnel and operatives available.
- (e) The shortage or excess of manpower (unemployment).

These items must be considered very carefully. It is important to keep in mind that substantial economies can often be attained by rationalizing traditional construction methods. Such measures do not require capital investment and are not so demanding on skilled personnel.

34. The rationalization of site operations is the first step in industrialization. Its purpose, apart from direct economic benefit, is to remove impediments to the introduction of more advanced industrial methods. Rationalized methods which may be introduced include the preparation of plans for full and efficient use of the site plant, the flow-line method of construction, the preparation of typified designs for repeated use, and adjustments and improvements in construction tools and equipment.^{17/} Establishment of temporary site plants to produce building components such as floor slabs and roof trusses and to produce concrete, prefabricate plumbing assemblies, bend reinforcing steel, etc., is a good example of the rationalization used in some developing countries with beneficial results.^{18/} These are measures that mainly involve organizational or technical adjustments in site operations to utilize more efficiently the available manpower, plant and materials. Generally, little or no additional investment is required for their implementation, but their

^{17/} Ref. No. 9.

^{18/} Ref. No. 5.

cumulative effects can result in a considerable increase in labour productivity and an improvement in the quality of construction. All proposals for rationalized methods must be carefully evaluated to ensure that real benefits will result from their production. To be effective, they must be implemented as widely as possible throughout the industry. To ensure proper evaluation and full implementation, a national construction council or similar body should be established with the participation of governmental agencies concerned with building programmes and of other entities concerned in the building process.

35. Mechanization on the site is the principal means to increase labour productivity for operations which cannot be transferred to permanent workshops. Thus, it represents also the principal means for industrialization of such operations. Machines are used mainly for earth moving, concrete and mortar mixing, transport to and on the building site, cutting holes, and for finishing work such as plastering, sanding walls, smoothing floors, etc. The table below shows the number of workers who can be replaced by machines of various types.

Table 4

Replacement of human labour by machines

<u>Types of machine</u>	<u>Labourers replaced</u>
Excavators 0,15 - 3 m ³	20 - 160
Motorscrapers from 6 m ³	50 - 120
Lozers from 80 H.P.	70 - 90
Motorgraders 50 - 120 H.P.	30 - 50
Machines for earth compaction 4 - 25 metric tons	20 - 50
Building cranes 30 - 80 metric ton-metres	30 - 40
Dumpcars 3 - 5 m ³	20 - 30
Motorcranes 5 metric tons	10 - 20
Mixers 250 - 750 litres	5 - 20
Conveyors 4 - 15 m	3 - 5

With the use of a greater number and range of machines on a project, the total of unskilled labour required for the same output is reduced but the demand for skilled men to operate and maintain the machines is increased. This could be a problem in developing countries, and must be taken into consideration.

36. Conditions for the introduction of mechanization are more favourable in cases where wages are high in comparison with the cost of machines. Where this ratio is reversed, as is often the case in developing countries, the situation is less favourable for the use of machines. The existing level of productivity of unskilled manual labour in developing countries is sometimes so low that even minor improvements in tools, organization, supervision, etc., can yield remarkable results and can move considerably upwards the threshold of labour's competitiveness with heavy plant and machinery.^{19/} Another factor to be considered in any proposal for mechanization is whether the heavy plant and machinery required must be imported, and the consequent strain this may place on foreign currency resources. Conditions may change very rapidly, however, and it is necessary to plan the technical development of construction within the framework of both the existing situation and the long-term plans for the entire national economy.

37. The assembly of buildings from factory-made components is the most effective method for industrialization of construction. It divides the process of construction into two phases: the production of components in permanent workshops, and their assembly on the site. Operations that are transferred from site to factory are then more readily subjected to the application of industrial methods which are characterized by high labour productivity. In addition, production is no longer influenced by weather conditions and the work force involved enjoys working conditions similar to those pertaining in other industrial branches; this reduces turnover of labour and assists in the creation of permanent working groups. Apart from the labour employed for plant maintenance, the level of skill and of qualifications required of the workers is generally lower than is required for the same operation on site. The assembly of buildings from prefabricated components takes less time than traditional site operations and is not influenced by weather to the same extent. However, before this method of construction can be employed, certain conditions must be fulfilled, the most important of which are capital investment in buildings and plant for precasting works, ensuring continuing sale for their products, and standardizing the requirements imposed on buildings. It is always advisable, therefore, to consider carefully whether it may be more convenient, at least for the time being, to use site prefabrication, which does not raise such serious implications and which may still improve productivity considerably.

^{19/} Ibid.

38. Analyses reveal that in countries which have amassed some experience with industrial methods of production and assembly of prefabricated components, the over-all cost of prefabricated buildings is lower than that of conventional buildings by about 10 to 15 per cent.^{20/} In countries where the production of components is undertaken only on a small scale, and especially where conventional construction methods are well organized and rationalized, costs are generally higher than for traditional building. The use of industrial methods results in far greater savings in labour requirements and construction time than in construction costs, mainly for the reason that their use is necessarily limited to certain areas of the entire production process. Cost studies show that the present-day level of industrial production in the building sector has a considerable potential for further savings. It is highly probable that further technical development, particularly in mechanization and automation, as well as the consistent application of modern organization methods used in industrial production, will lead to additional substantial economies.

39. An important problem in the further development of industrialized building is the determination of the optimum capacity of a factory to produce building components. While an increase in production capacity will reduce both the initial and production unit costs, it usually will also increase the area which the factory supplies and thereby will increase the cost of transporting components to various sites. In considering the expansion of a plant, the net effect of the unit cost savings that will be realized from the proposed increase in factory capacity, and the increase in average transport costs, must be taken into account. In areas where construction requirements are concentrated, larger precasting plants will be justified than in the case of regions where construction activities are dispersed over a large area.

Design, standardization and use of mathematical methods and computers

40. Design and standardization form an important part of the preparation for construction, both in developed and developing countries, and influence not only t

^{20/} Ref. Nos. 10 and 11.

^{21/} Ref. No. 12. For more information, see also part I, chapter IV, "Development of the Building Materials and Components Sector".

quality but also the method of construction, the productivity of labour, and construction costs. Design and standardization can be used, therefore, to assist in the industrialization of construction. On the other hand, the contemporary state of construction materials, and technology determines, to a considerable extent, the level of standardization and design that is possible.^{22/}

41. In addition to standards for building materials, products and processes, standards for dimensional (modular) co-ordination are extremely important since they are necessary for the application of assembly methods to construction and for the use of industrial products, particularly building components. From the viewpoint of international trade in building materials and components (and machinery for their production), it is essential that the basis for standardization and particularly for modular co-ordination, be accepted internationally. This is not the case at present, and countries which import most of their building components or plants often encounter difficulties as a result of the differing bases for standardization that apply in the exporting countries.^{23/} For this reason, international unification of standardization and standards, particularly those concerned with the dimensions and quality of products, should be encouraged. Agreements and contracts concluded in the field of foreign trade can be used to further this aim. International unification of the principles of standardization is very important for developing countries and should be supported by all possible means. There are some real obstacles to achievement of this desirable goal but as a first step it may be possible to agree on certain selected dimensions or important physical characteristics for the more commonly used building products.

42. Another field for standardization that can considerably influence the quality of design concerns the functional requirements imposed on buildings. For various types of buildings, such items as permissible loading, requirements for thermal insulation, sound insulation and fire resistance, room dimensions and ceiling heights, etc., should be standardized. The quality of these standards considerably influences the physical and cultural quality of the living environment created by the buildings in question. Non-uniformity and lack of co-ordination of these standards,

^{22/} Op. cit.

^{23/} Ref. No. 13.

particularly if they were formulated without considering the need also to unify building components and products, can considerably retard the process of standardization, and consequently the industrialization of construction. Developing countries that are only beginning to issue standards, building regulations and by-laws should prepare them from the start in such a way as to ensure a high standard of building and town development, and to allow readily for the introduction of more highly productive and economical methods of construction. These two aims are not contradictory and, if given full consideration, both can be satisfied.

43. A highly effective means of rationalizing the industry is the use of typified (model) designs. These should be used to improve the functional quality of buildings, as well as to increase the productivity of the construction industry. Provided that sound principles of architectural and town-planning design are maintained, the use of typified designs can benefit both the client and the contractor, and can result in considerable economies and improvement in the quality of construction. To obtain full benefits from this measure, the public or private clients, together with the construction industry, must agree on the most suitable designs and then subject them to repetitive use. In some countries, typified designs are widely used and they help to increase the efficiency of the construction industry. However, care must be exercised to ensure that their use does not have a harmful effect on the quality of architectural and town-planning design. At times, the use of typified designs is improperly understood by architects and investors, and this can impede technical progress and lower the productivity of the construction industry.

44. It may be advantageous to entrust the development of typified designs to design firms or institutions that are well provided with qualified personnel, experienced in designing the type of building concerned. They must work in close co-operation with the firms that will undertake construction to these designs, as well as with the firms that will supply the building materials and components.

45. When typified designs are considered, they should be evaluated in terms of their ultimate social and cultural impact as well as in economic terms. Large-scale construction of identical buildings, however high their quality, will not necessarily satisfy all of the various functional or town-planning requirements. The selection of buildings to be typified, and their design, should conform to the architectural design of larger town-planning units.

46. The development of industrial methods, the increasing capacity of the construction industry, the size of building corporations and projects, the full utilization of highly efficient machines, and the co-ordination of a multitude of subcontractors and operations, all require that more efficient methods for the preparation, programming and control of the whole construction process be developed and applied. Operations research and the application of computers (which have already found many fields for application in other sectors of the national economy) are also becoming important aids to the construction industry. With their use, it is possible to introduce progressive forms of organization and management, as they enable a speedy analysis of complex situations such as the relative effectiveness of various production methods, a comparison of various designs, the selection of the most economic investments, etc. In recent years, these aids have been applied more frequently in planning and controlling large projects, determining the demands being made on the construction industry, preparing long-term programmes, in town and country planning, design of buildings and the calculation of complex structures.

47. In some countries, the Government has helped to establish committees whose purpose is to spread the use of computers and mathematical methods in the construction industry, through exchange of information and experience. In other countries, the Government has made this activity the responsibility of certain research or design institutions. These institutions provide information on the available computer programmes and advice on how computers may be used. Their duties usually include the training of specialists in the application of mathematical methods in various fields of the construction industry.

Research, development and technical information

48. Government policies concerning the technical development of construction and related investment, as well as government measures for standardization, should be based on the evaluation of technical information, development and research.

49. Where technical development is to be furthered by rationalization of construction techniques, mechanization and site prefabrication, this can be realized within individual construction firms. However, where the introduction of new factory-made components is involved, much wider participation is required. Experience shows that a considerable period of time, about three or four years, is required for technical development, standardization and building workshops to produce components, before actual construction is started on an industrial basis.

50. New methods of construction often require the development of new materials and components and conversely, the development of new materials requires new construction methods. Therefore, it is desirable that technical information in both fields be co-ordinated and disseminated.^{24/}

51. In developed countries, research, development and technical information in the construction industry involve the determination of the functional characteristics of buildings and their relationship to town planning, structural design, construction techniques, and building materials and components. In some countries, several institutions exist, and each pertains to a particular branch of the construction industry. In addition, these countries have a special body to deal with technical information and standardization. In other countries, all research activities are concentrated in one institution, while two separate organizations exist for technical information and standardization purposes.

52. In countries where industrial development is just starting it is preferable to set up only one central authority, to be responsible for promoting technical development in the building industry. Concentration of all development activities in a single institution will help to eliminate duplication and will make the maximum use of the qualified staff available. Its functions would include evaluation of the experience of other countries for application in the home country, arrangements for training courses and experimental construction, and dissemination of technical literature. It should also prepare basic data, from available information (supplemented by its own research, where necessary), to establish standards for building products, construction methods and functional requirements, and it should co-operate in the development of typified designs.

53. At a later stage, when more people have been trained, standardization can be separated from research, and these two functions can be further broken down, if desired, to correspond to the various parts of the construction industry. As far as technical information is concerned, however, it is advisable that this function for the whole field of construction should be retained under a single authority, either as part of a research or development institution or separate from it.

^{24/} Op. cit.

Education and training for the construction industry

54. The first step to be taken before embarking on any professional training programme is to determine the probable requirements for individual professions. In developed countries, the number of technical and administrative employees varies from 14 to 23 per cent of the total construction labour force, as shown in the following table. About one-fifth to one-half of these technical and administrative employees have a university education.

Table 5

Ratio of technical and administrative employees to
total number of employees in selected countries

Sweden	23.5% (1960)
Germany, Eastern	22.5% (1963)
Poland	21.0% (1964)
Norway	20.0% (1960)
Netherlands	20.0% (1960)
Czechoslovakia	18.2% (1964)
Austria	18.0% (1951)
Germany, Federal Republic of	18.0% (1950)
United Kingdom	18.0% (1951)
Hungary	17.0% (1964)
Soviet Union	15.0% (1964)
United States	14.0% (1962)

These ratios are increasing since further industrialization requires additions to the number, and improvement in the quality, of technical and administrative employees. Furthermore, in developed countries, the number of apprentices normally constitutes about 5 to 10 per cent of the construction labour force, while the total number of skilled workers is about 50 per cent of the total labour force, as the following table shows.

Table 6
Breakdown by trade of construction workers in selected countries
(as percentage of total)

	United States 1960	German Fed. Republic 1963	Sweden 1960	Nether- lands 1962	Czecho- slovakia 1962
<u>Skilled workers</u>	57.5	44.1	53.4	-	47.7
<u>Out of total (skilled workers)</u>					
Masons	4.4+1	20.7	-	16.8	18.1
Carpenters	19.5	7.8	-	20.7	6.0
Concretors	0.9	1.6	-	6.4	5.3
Electricians	8.0	-	6.5	-	-
Operators of earth-moving machines	4.7	-	-	-	-
Painters	8.8	6.7	9.1	5.5	7.2
Plumbers	7.3	-	8.5	-	4.4
Operators of cranes	3.0	7.0	-	-	-
<u>Unskilled Labourers</u>	17.4	35.3	23.1	-	29.4
<u>Others</u>	25.1	20.6	23.5	20.0	22.9

With industrialization, these ratios undergo changes, and the breakdown of the labour force into the various trades also changes: the ratio of masons and concrete workers decreases, while the ratio of machine operators, plumbers, etc., increases.

55. In developing countries, the shortage of qualified personnel and skilled labour is so great that a considerable period of time will be required before the situation can be improved. The fact that working conditions on a construction site are generally not as favourable as in other industrial branches, coupled with the fact that construction employment at a particular site is only temporary, results in many construction workers leaving the industry. Recruitment and training of greater numbers are therefore required to allow for this wastage. Often, most of the workers enlisted by the construction industry are illiterate and in such circumstances, object-teaching on the site is the most suitable educational method to employ for short-term results. Despite the fact that special training for instructors is required, positive results have been achieved in a number of countries by that means.^{25/}

56. A large part of the construction labour force in developing countries, especially in rural areas, is employed by small local firms, which are not accustomed to operating within the standard technical and administrative framework that exists in developed countries. If a number of small firms are concentrated together on one project, it is possible to train the foremen gradually in the use of simple, rationalized construction methods, as well as in the use of detailed designs, site plans, specifications, etc. Such a scheme would supplement the more formal training given by technical and trade schools, and would assist in creating a wide and firm basis within the industry for gradual transition to more productive techniques. However, until some training has been undertaken in the construction industry, government departments involved in construction should use simple methods in arranging for construction work to be carried out. The departments should only introduce modern contractual procedures gradually, as experience in their use is built up.

Recommendations

57. The scope and relevance of the problems involved in this study make it necessary to select the problems of basic importance in order to formulate recommendations for action and follow-up work at the national level. Action at the regional and/or the world level is suggested in the cases where a common solution, advice and assistance may lead to more rapid and efficient progress in the construction field.

58. A major goal of Governments should be to ensure a steady increase in demand for construction within the framework of the development plans for the entire national economy. The most effective means of achieving this aim is through the preparation of a programme of public investment (dams, irrigation schemes, transport structures, large industrial and residential projects, etc.) on the basis of long-term economic plans. Such a programme should be substantiated by plans in physical terms for the important development regions of the country. These plans should then be used as the basis for concentration and co-ordination of investment in such a way as to ensure the continuing and concentrated activity of the building industry. Over the years, the long-term plans can be elaborated in greater detail and can be modified, where necessary, to take account of private investments in order to ensure that the total annual volume of construction activity continually changes in accord with the increasing capacity of the industry.

59. Other measures that may be employed to encourage the development of the construction industry are:

- (a) Long-term orders to construction firms with a potential for development of new techniques.
- (b) Where necessary, modernization of laws and regulations, including those pertaining to land acquisition, to ensure that they do not inhibit development.
- (c) Collection and dissemination of statistical information on the industry.

60. Before starting the industrialization of construction, it is advisable that the government institutions concerned should carefully consider any technical development plans in the light of the country's economic resources and the capability of the construction industry. In other words, consideration should be given to the availability of capital, the question whether materials can be manufactured in the country or must be imported, assurance as to continuity of demand, the technical capability of construction companies, and the general employment situation.

61. As a first step, it is necessary to rationalize operations on the site in order to remedy organizational and technical defects of traditional methods that are impeding the economical use of more advanced industrial methods. In some developing countries, the existing economic situation may indicate that rationalizing measures will provide the only avenue by which increased efficiency can be attained over the short term. In these cases, all of the minor technical and organizational changes that give hope for improvement should be considered. There is a wide range of construction activities in which a close examination will bring fruitful results, such as improvements in construction technology, development of simpler machines and improvements in machines already in use, and establishment of temporary site plants to produce simple building components. A national organization should be set up to promote rationalized methods.

62. When conditions are suitable for further advances in industrialization, the next step is to prepare a plan for investment in precasting works and a contractor's plant to ensure that the construction industry has the means and capacity to carry out the development plans. Before such investments are made, however, at least two or three alternative schemes should be prepared in order to find the best solution. These schemes should be selected to provide a comparison of such alternatives as

importing versus home manufacture of materials, a certain technology for construction or building materials versus another technology, and so on. The task of preparing and evaluating such plans is a complex and difficult one, and the possible high cost of a wrong decision should be fully realized.

63. When machines are being purchased, it must be borne in mind that they will require repair and maintenance; this will be much more difficult and expensive if different makes of machines are used for the same purpose. Repair shops that are well stocked with spare parts and equipped for at least minimum repairs, will be required. Defects in this service may reduce considerably the advantages to be gained from mechanization.

64. For developing countries at the initial stage of building industrialization, it is generally advantageous to have temporary or permanent plants for prefabricated building components established as part of individual building corporations. In countries where some experience in this field has been acquired, and where building activities are already concentrated to a degree, it is preferable to encourage the establishment of separate corporations for building components production. At first, these corporations may manufacture a fairly wide assortment of products, but a gradual specialization should be fostered. In either case, new precasting plants, even of a temporary nature, should be located with due regard to both the present and expected future centre of building activities. In this way, the transition to higher forms of industrial production can be effected more efficiently. If suitably located, even small temporary-site plants can eventually develop into large independent works, capable of supplying specialized products to building sites over a wide area.

65. Lack of uniformity in standardization and modular (dimensional) co-ordination, both at the national and the international level, inhibits the development of the construction industry and reduces its productivity. For progress to be made, it is essential that the quality and dimensions of commonly used building materials and components be standardized at the national level. Standardization is very desirable also at the international level, particularly the regional level, so that building materials can be imported and used by the home industry without the difficulties involved in the use, on the same structure, of various materials which have been standardized on different bases. International unification of standards and standardization should therefore be supported to the fullest possible extent.

66. The wider use of typified (model) designs may improve the functional quality of buildings, as well as the productivity and economy of the construction industry. It is in the interest of Governments to entrust the development of typified designs only to fully qualified design firms or institutes, and to provide material support to them.

67. Co-operation among the smaller investors (private or public) in obtaining and using suitable typified designs should be encouraged. If this work is arranged in co-ordination with the qualified design organizations and contracting firms, it may profit all concerned. The stronger investor organizations are likely to be better equipped and able to formulate the functional requirements of buildings. This may also result in a more rational concentration and more economic use of investments.

68. To develop the use of mathematical methods and computers (which are becoming increasingly helpful to the construction industry), and to train specialists in this field, Governments should organize committees or entrust these tasks to appropriate research or design institutes.

69. Governments should be assisted by appropriate research or development institutions in formulating policies for the technical development of, and investment in, the construction industry.

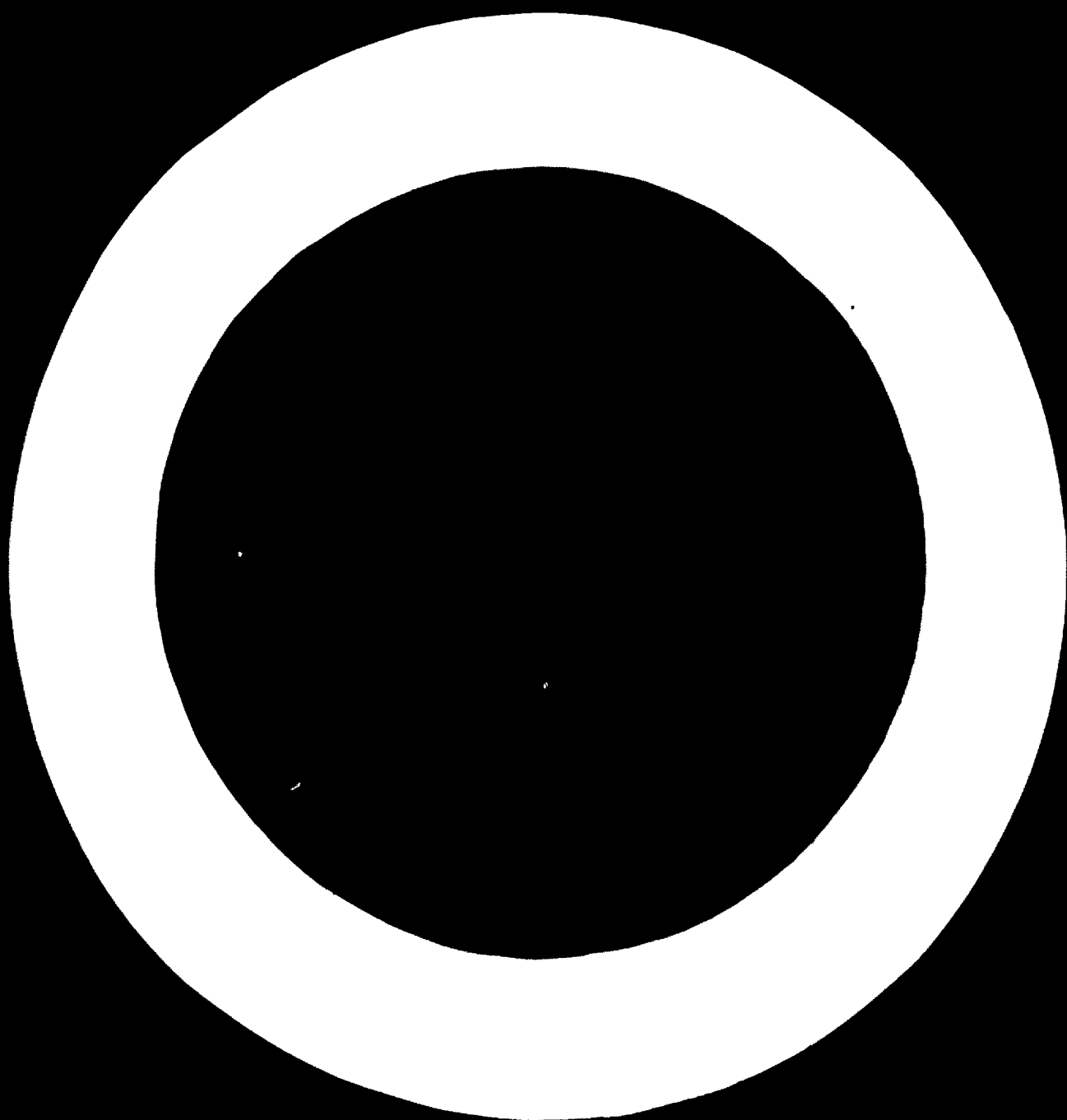
70. In developing countries, particularly if industrialization is just starting and if qualified personnel is scarce, the establishment of one central institution seems to be the best solution. It should be responsible for collecting, evaluating and disseminating technical information (which may be supplemented, if necessary, by data obtained through its own research programme, and for preparing building standards.

71. At a later stage, when industrialization is more advanced, it will be possible and perhaps advantageous to divide the research and development services between two or more organizations.

72. The lack of qualified personnel and skilled labour is one of the main obstacles impeding progress in the construction industry of developing countries. Therefore, a programme of education and training at all levels will constitute, for a long time to come, the most important part of any plan for technical development of the construction industry.

73. In addition to the traditional methods (schools), Governments should make use of the less conventional forms of education, designed to meet the existing conditions. For example, object-teaching on a building site is an efficient training method for illiterate labourers.

74. The education and training programme should encompass at least some of the large number of small firms in rural areas, as these firms are not generally experienced in conventional design and contractual procedures. Governments may consider the joint employment, on a suitable project, of a certain number of such firms, in order to provide an opportunity to train the foremen gradually in the use of more rational methods of construction, design, specifications, etc.



ANNEX I

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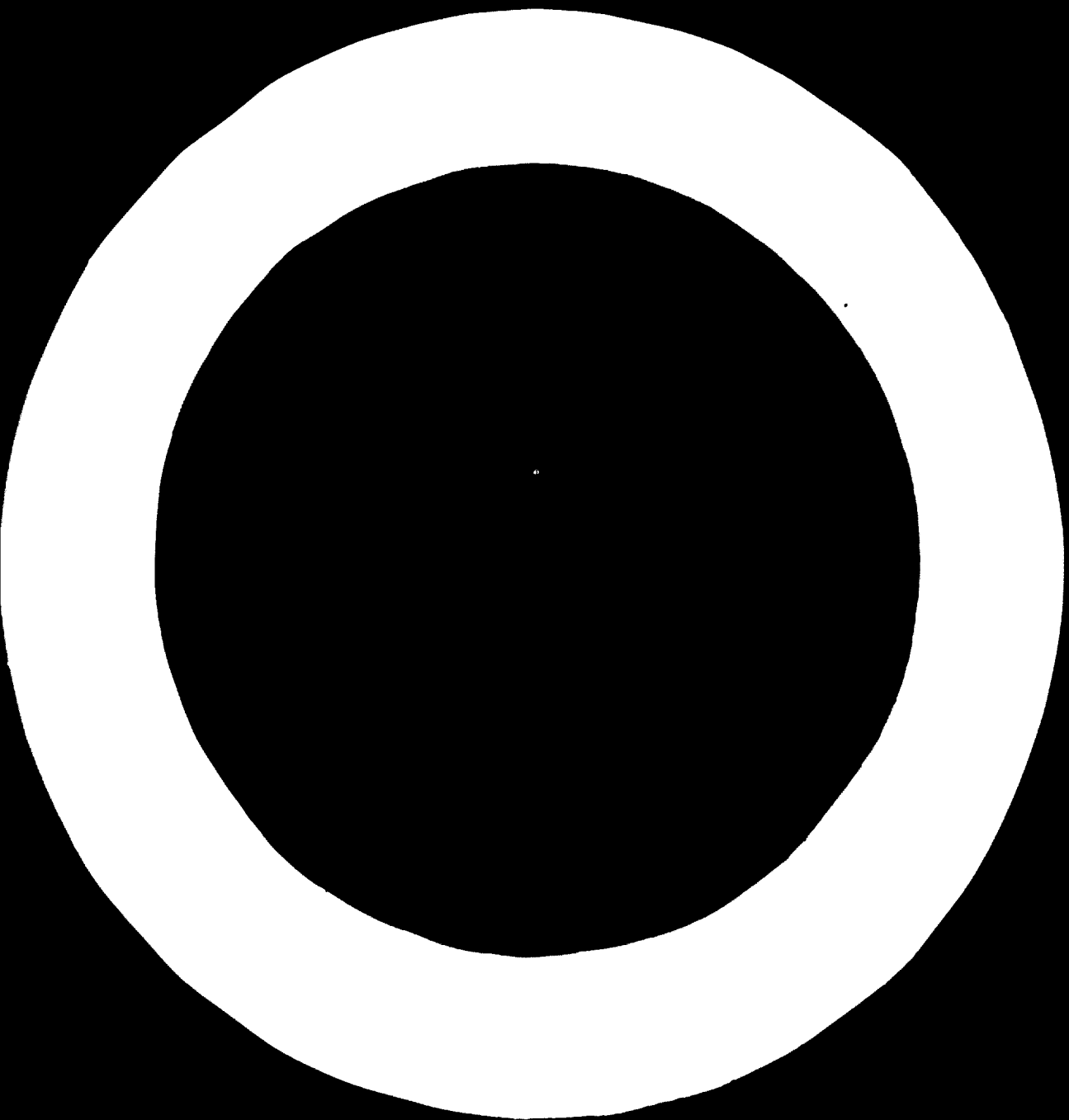


Table A - Major economic indicators in construction, 1977-1985

STROU	COUNTRY	Average annual rates of growth				Gross fixed capital formation in construction as a percentage of total fixed capital formation				Value added by construction as a percentage of Gross Domestic Product				Buildings, construction, and other construction as a percentage of the stock				Population data		
		Total		Non-residential		Period		Type of Stock		Period		Type of Stock		Period		Type of Stock		Page	Annual rate of increase 1977-85	
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16			17
AL	ALGERIA	7.3	7.3	7.3	7.3	1977-85	1977-85	1977-85	1977-85	1977-85	1977-85	1977-85	1977-85	1977-85	1977-85	1977-85	1977-85	1977-85	1977-85	1977-85
BE	BELGIUM	7.3	7.3	7.3	7.3	1977-85	1977-85	1977-85	1977-85	1977-85	1977-85	1977-85	1977-85	1977-85	1977-85	1977-85	1977-85	1977-85	1977-85	1977-85
BR	BRAZIL	7.3	7.3	7.3	7.3	1977-85	1977-85	1977-85	1977-85	1977-85	1977-85	1977-85	1977-85	1977-85	1977-85	1977-85	1977-85	1977-85	1977-85	1977-85
CA	CANADA	7.3	7.3	7.3	7.3	1977-85	1977-85	1977-85	1977-85	1977-85	1977-85	1977-85	1977-85	1977-85	1977-85	1977-85	1977-85	1977-85	1977-85	1977-85
CH	CHINA	7.3	7.3	7.3	7.3	1977-85	1977-85	1977-85	1977-85	1977-85	1977-85	1977-85	1977-85	1977-85	1977-85	1977-85	1977-85	1977-85	1977-85	1977-85
FR	FRANCE	7.3	7.3	7.3	7.3	1977-85	1977-85	1977-85	1977-85	1977-85	1977-85	1977-85	1977-85	1977-85	1977-85	1977-85	1977-85	1977-85	1977-85	1977-85
GR	GREECE	7.3	7.3	7.3	7.3	1977-85	1977-85	1977-85	1977-85	1977-85	1977-85	1977-85	1977-85	1977-85	1977-85	1977-85	1977-85	1977-85	1977-85	1977-85
IN	INDIA	7.3	7.3	7.3	7.3	1977-85	1977-85	1977-85	1977-85	1977-85	1977-85	1977-85	1977-85	1977-85	1977-85	1977-85	1977-85	1977-85	1977-85	1977-85
IT	ITALY	7.3	7.3	7.3	7.3	1977-85	1977-85	1977-85	1977-85	1977-85	1977-85	1977-85	1977-85	1977-85	1977-85	1977-85	1977-85	1977-85	1977-85	1977-85
JP	JAPAN	7.3	7.3	7.3	7.3	1977-85	1977-85	1977-85	1977-85	1977-85	1977-85	1977-85	1977-85	1977-85	1977-85	1977-85	1977-85	1977-85	1977-85	1977-85
US	UNITED STATES	7.3	7.3	7.3	7.3	1977-85	1977-85	1977-85	1977-85	1977-85	1977-85	1977-85	1977-85	1977-85	1977-85	1977-85	1977-85	1977-85	1977-85	1977-85

ANNEX II

TABLES, GRAPHS AND FIGURES

ID/CONF.1/24
English
Annex II
Page 1

Table A - Major economic indicators in construction, 1955-1963 (continued)

STANDARD COUNTRY	Per capita constant factor price	Average annual rate of growth			Gross domestic fixed capital formation in construction			Value added by construction as a percentage of Gross Domestic Product			Dwellings, non-residential and other constructions and works as a percentage of the whole			Population data			
		Real Green Domestic Product at constant factor cost 1955=100	Per Capita Constant Factor Price	Total Construction in constant price	As a percentage of total G.D.P.			Ratio of construction to G.D.P.	Type of construction	Year			Thousand	Annual rate of increase 1958-63			
					Period	Ratio	Symbol			Year	Year	Year					
SWI SWITZERLAND	2295	1950-55 5.7	3.6	6.1	1955	55	20	32.7	BB			1955 50 1963 56	64	7,400	0.3		
DNK DENMARK	1879	1950-55 3.8	3.2	7.5	1955-65	65	15.9	35.4	AA			1955 55 1963 60	35	5,100	0.1		
GBR GREAT BRITAIN	1077	1950-55 2.5	2.1	6.6	1955-63	63	8.0	6.9	BB			1955 55 1963 59	44	51,000	0.7		
CZECHOSLOVAKIA																	
CZE CZECHOSLOVAKIA	1232	1955-60 4.5			1955-63	63						1955 55 1963 60	7.0				
AUS AUSTRALIA	1353	1955-65 5.9			1955-63	63						1955 55 1963 60	6.9			9,000	0.1
FIN FINLAND	1678	1955-65			1955-63	63						1955 55 1963 60				3,200	0.8
FRANCE																	
FRA FRANCE	1617	1955-65			1955-63	63						1955 55 1963 60				22,000	0.7
HUNGARY																	
HUN HUNGARY	1898	1955-63			1955-63	63						1955 55 1963 60				15,000	0.7
POLAND																	
POL POLAND	1904	1955-63			1955-63	63						1955 55 1963 60				16,000	0.8
ROMANIA																	
ROM ROMANIA	1994	1955-63			1955-63	63						1955 55 1963 60				9,000	0.4
USSR																	
USSR U.S.S.R.	1898	1955-61 9.1	7.5	7.5	1955-63	63						1955 55 1963 60				201,000	1.7
YUGOSLAVIA																	
YUG YUGOSLAVIA	1898	1955-61 8.3	7.8	7.8	1955-63	63						1955 55 1963 60				10,100	1.1

Source: Yearbook of National Accounts Statistics, 1965 (United Nations, New York, 1965)

Footnote:
1) Green popn.
2) Green popn. at constant factor price
3) Constant price 1955
4) Green and N.A. combined at constant price
5) Green popn. at constant price
6) Green popn. at constant price
7) Green popn. at constant price
8) Green popn. at constant price
9) Green popn. at constant price
10) Green popn. at constant price
11) Green popn. at constant price
12) Green popn. at constant price
13) Green popn. at constant price
14) Green popn. at constant price
15) Green popn. at constant price
16) Green popn. at constant price
17) Green popn. at constant price
18) Green popn. at constant price
19) Green popn. at constant price
20) Green popn. at constant price

The following symbols referring to columns 1, 3, 4 and 5 have been employed to indicate the type of estimate used for the firm and second approximations of the data respectively:
A at current market prices
B at current market prices for a given year
C at factor cost for a given year
D at factor cost for a given year
E net material product

Table B

Indices of employment in construction in selected
 African countries, 1958-1963

Index 1958 = 100

Country	1958	1959	1960	1961	1962	1963	Scope (thousands)
Cameroon	100	63	39	64	92	62	11.5
Gabon	100	73	80	72	96	92	3.8
Ghana	100	119	122	125	121	..	50.7
Kenya	100	92	97	84	37	55	34.2
Nigeria	100	83	91	72	81	..	12.3
Sierra Leone	100	108	103	134	122	135	8.5
Southern Rhodesia	100	92	89	70	58	49	73.4
Tanganyika	100	106	88	126	136	99	11.0
Uganda	100	87	80	77	77	69	38.0
United Arab Republic	100	99	86	90	85	..	79.0
Zambia	100	73	58	49	39	38	66.2

Source: Yearbook of Labour Statistics, 1964, International Labour Office.

Table C

Development of size of building firms

Country	Change of average number of employees	In the years	Number of firms	In the year
United States	9.4-11.2	1953-62	473,000 firms	1962
Japan	6.7-10.4	1954-60	245,500 "	1962
Belgium	9.8-11.1	1953-63	24,915 "	1963
France	4.9-5.2	1958-62	252,549 "	1962
Germany (Fed. Rep.)	8.9-13.2	1950-61	169,196 "	1961
Italy	12.5-11.3	1951-61	81,494 "	1961
Norway	11.5-9.5	1936-53	7,141 "	1953
Sweden	8.3-8.9	1931-51	27,440 "	1951
United Kingdom	13.8-16.4	1954-58	95,629 "	1958
Yugoslavia	435.0-476.0	1958-62	669 enterprises	1962
	16.4-25.9	1958-62	15,074 firms (inc. trades)	1962

Source: National yearbooks; Statistical Yearbooks (United Nations);
Housing in Africa (United Nations; 1965).

Table D

Average size of building enterprises in eastern European countries

Country	Average number of employees	Number of enterprises
USSR	641	10,676
Hungary	3,030	117
Germany, Eastern	1,175	257
Bulgaria	3,200	45
Poland	622	1,204
Romania	4,550	110
Czechoslovakia	1,705	262

Table E

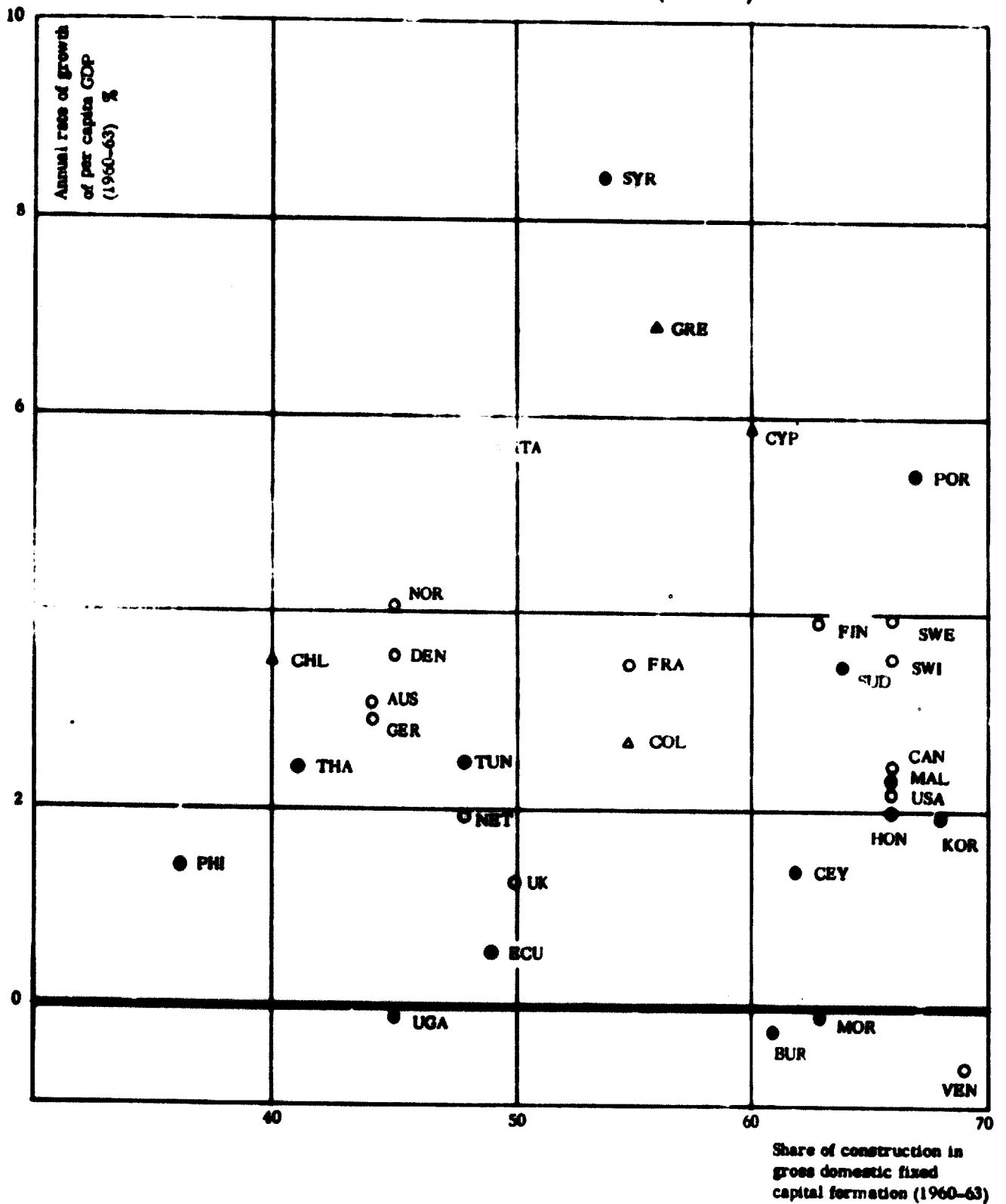
Concentration of building production

United States	1.7 per cent firms	carry out	80	per cent of production
United Kingdom	1.9 " " "	" "	58.3	" " " "
Germany (Fed.Rep.)	4.8 " " "	" "	45.8	" " " "
Canada	6.0 " " "	" "	47.6	" " " "
France	4.2 " " "	" "	70.0	" " " "
Sweden	0.01 " " "	" "	24.7	" " " "
Ivory Coast	30.0 " " "	" "	90.0	" " " "

Source: National yearbooks; Statistical Yearbooks (United Nations, Housing in Africa (United Nations, 1965)).

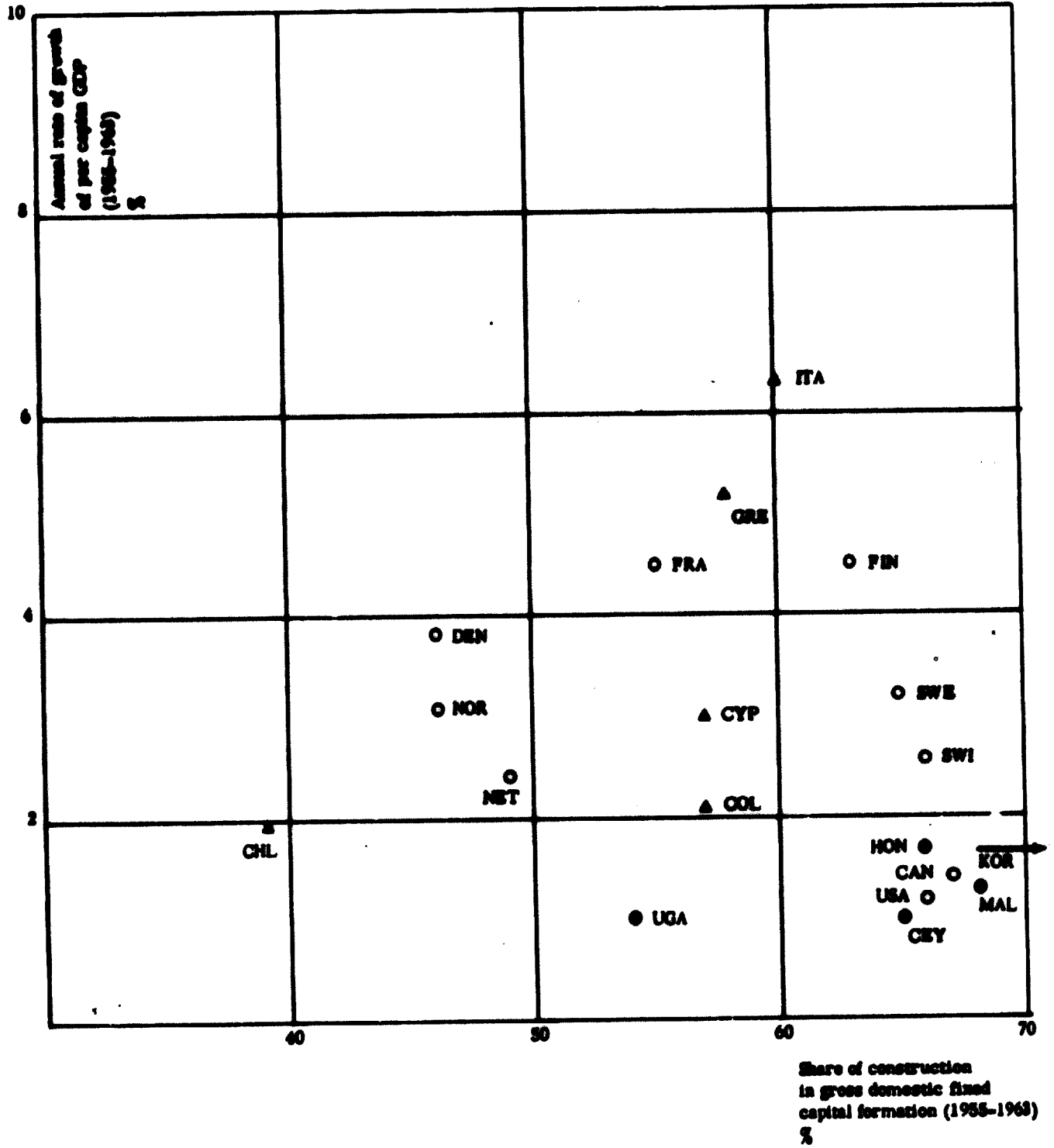
Relationship between the annual rate of growth of per capita gross domestic product and the share of construction in gross domestic fixed capital formation (1960-1963)

Graph A

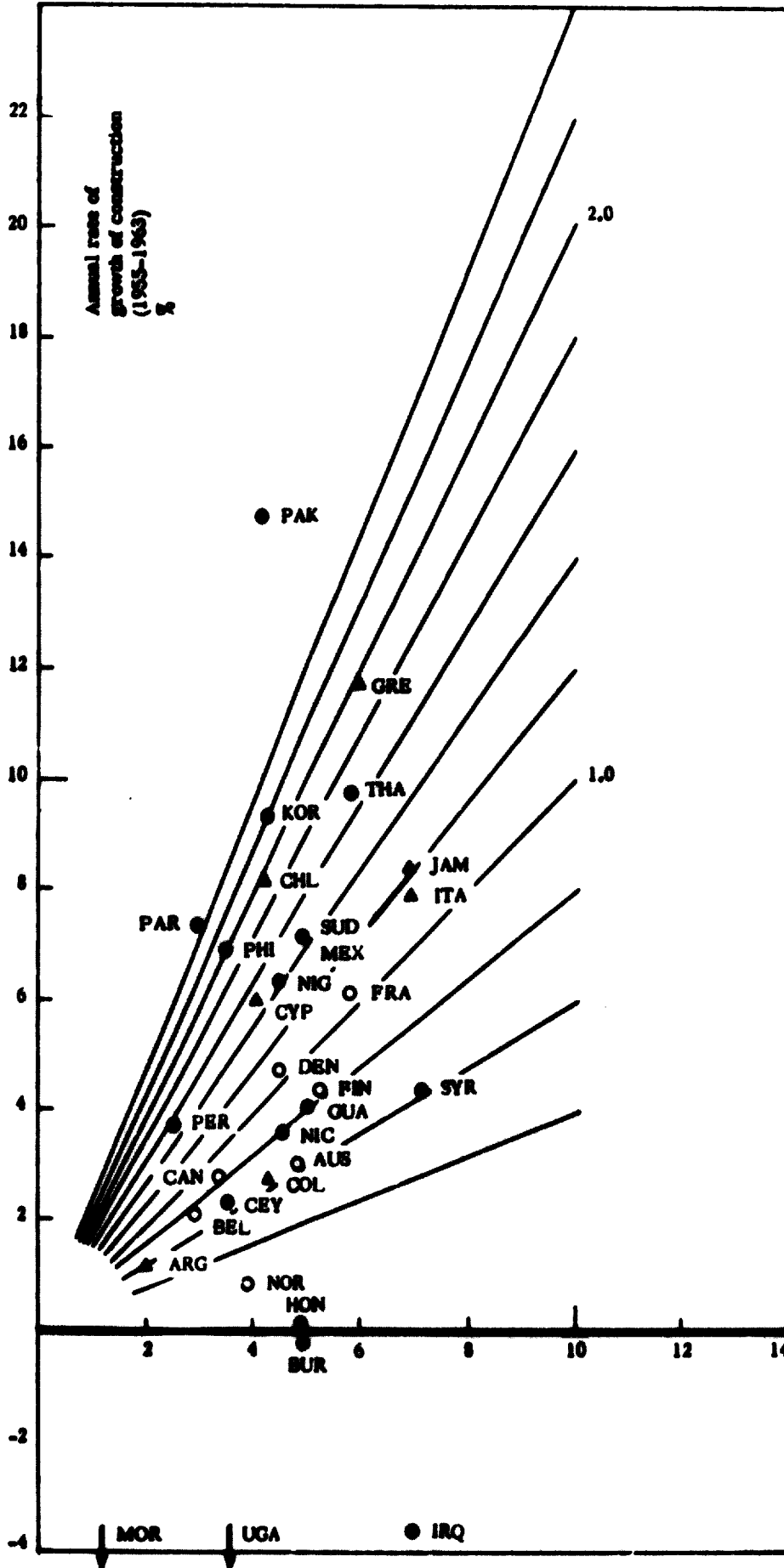


Relationship between the annual rate of growth of per capita gross domestic product and the share of construction in gross domestic fixed capital formation (1955-1968)

Graph B



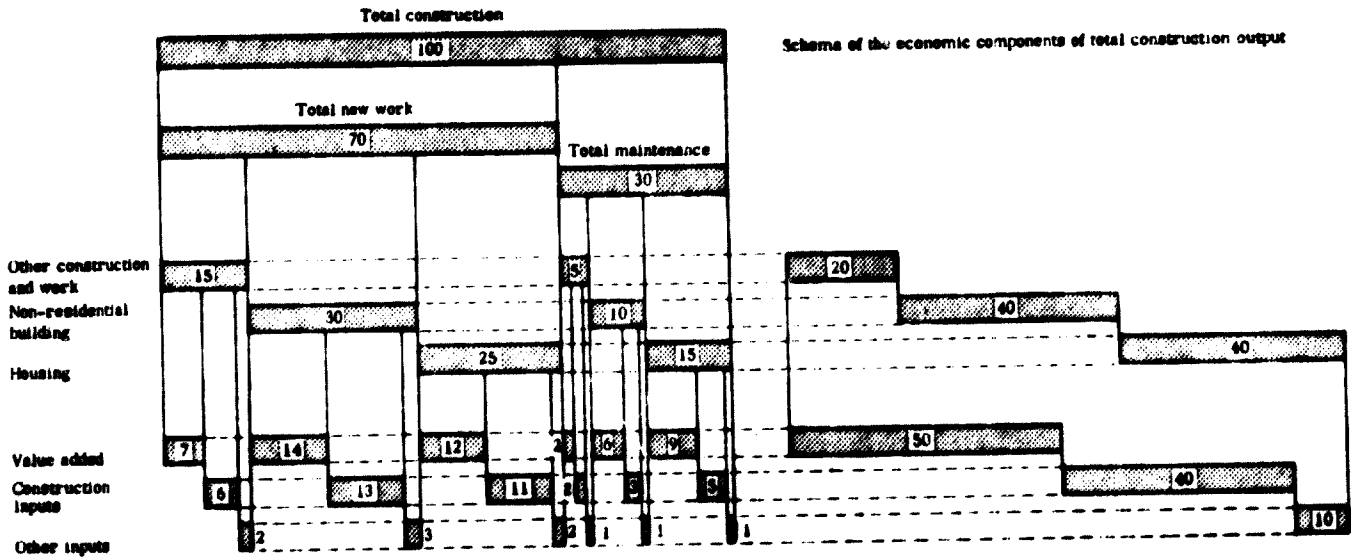
Graph C

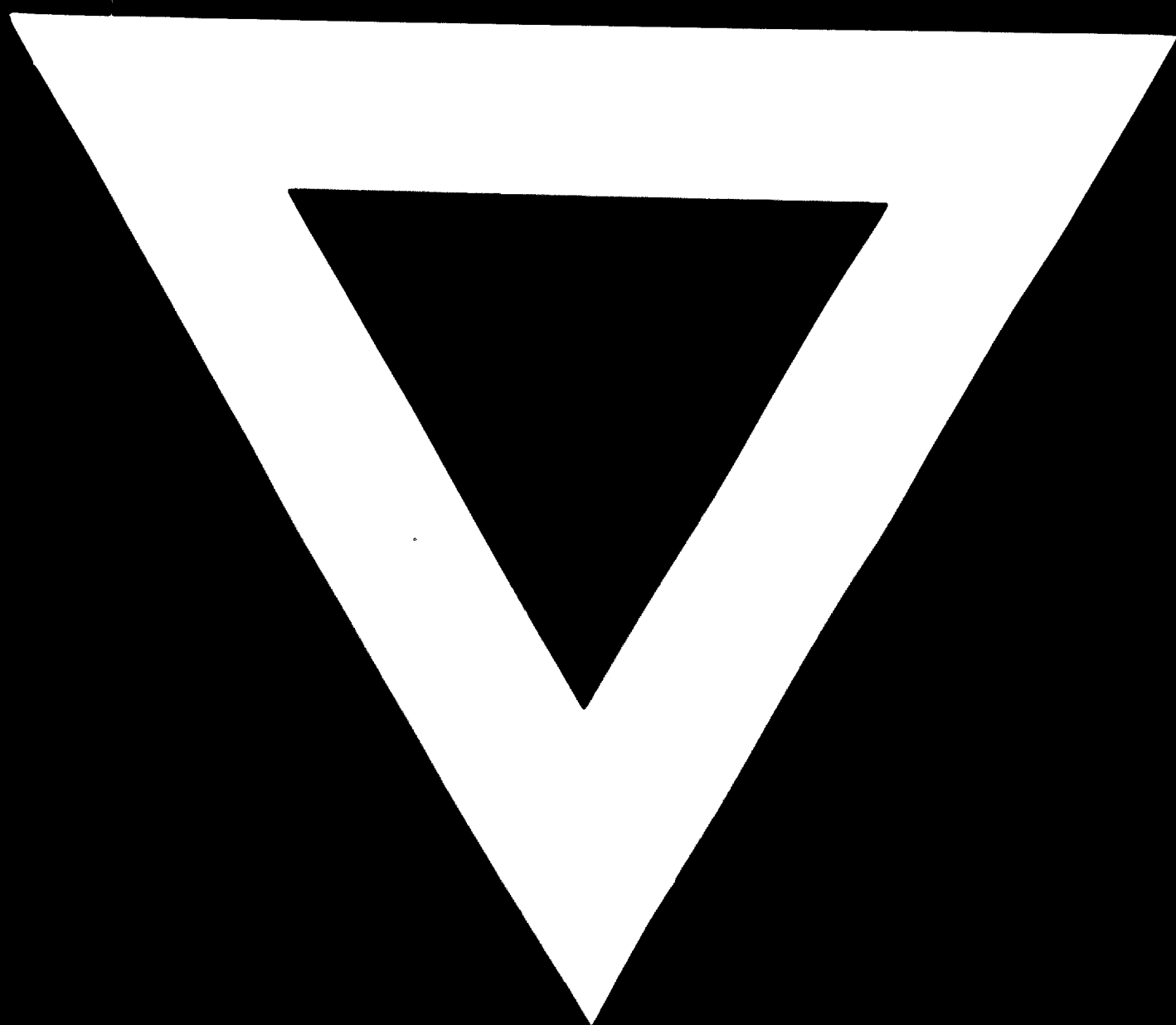


Relationship between the annual rates of growth of value added by construction and gross domestic product at factor cost (1955-1963)

Annual rate of growth of GDP (1955-63) %

Figure A





26. 6. 72