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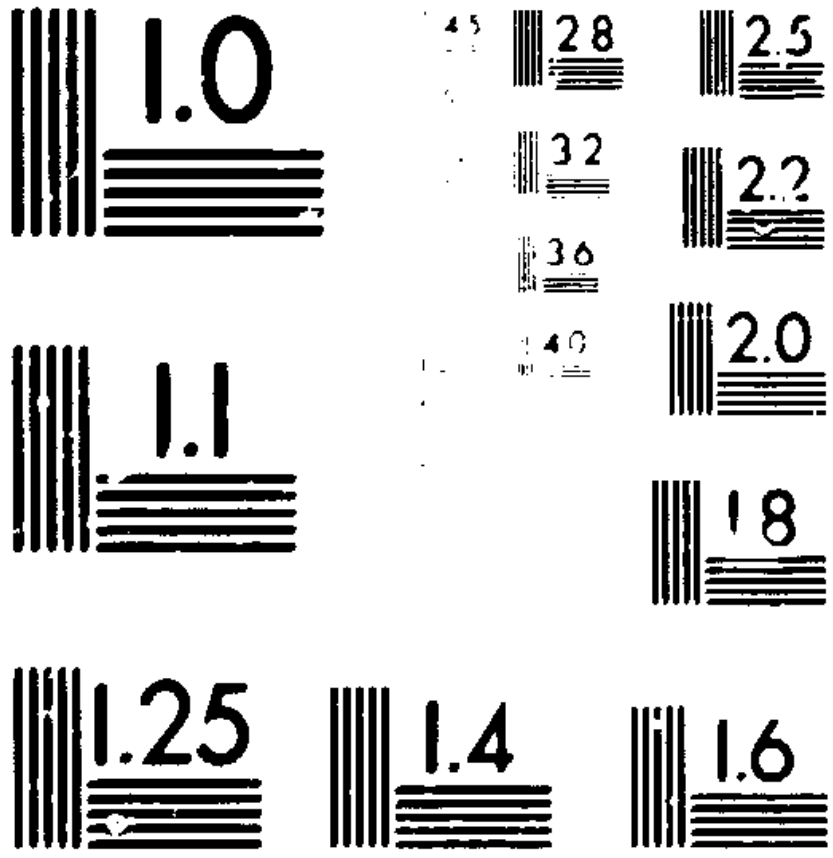

13918

Distr.
LIMITED

ID/WG.425/2
27 July 1984

ORIGINAL: ENGLISH

United Nations Industrial Development Organization

Global Preparatory Meeting for the
First Consultation on the
Building Materials Industry

Vienna, Austria, 24-28 September 1984

LONG-TERM FORECASTING AND PLANNING OF THE CONSTRUCTION AND BUILDING MATERIALS INDUSTRIES *

by

Jürgen Riedel **
UNIDO Consultant

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** Senior Research Fellow of the IFO-Institute for Economic Research, Munich, Federal Republic of Germany.

V.84-88856

Summary

This report prepared on behalf of UNIDO constitutes a background paper to assist in the preparation of world-wide consultations on construction and building materials industries. Its aim is not so much to describe the sector's performance and problems in developing countries which had been done in other UNIDO reports but to serve as a basis for discussion as well as guidelines for governments to set up or to improve their forecasting and planning mechanisms in this field.

The development of building materials production is exclusively dependent on construction activity. For forecasting and planning purposes, therefore, the two subsectors are understood as one entity. Furthermore, it is suggested to conceive them as a comprehensive system combining as well the interrelationships with other sectors and the various parties involved in the planning, design and performance of the construction and building materials production process. Such a multifaceted approach implies the extension of traditional methodology and creates large coordination requirements which are difficult to cope with in the light of prevailing disciplinary institutional separation and the respective information network.

The paper is structured as follows: After arguing the needs for improved forecasting and planning and a description of the construction and building materials system efforts are made, first, to establish a forecasting and planning system. Its preconditions as well as different types of demand forecasts in national development plans are outlined. A major emphasis is, secondly, placed on the discussion of long-term forecasting methods of the demand side (chapter VI). Following a step by step approach a (disaggregated) method is elaborated which constitutes a link between highly aggregated macro-economic methods, on the

one hand, and programming as well as operational (project) decision making, on the other. Third, the analysis focuses on forecasting the supply side. It is argued (chapters VII and VIII) that the main issue in developing countries is to promote the sector's performance in order to keep pace with growing demand by reducing import dependencies and strengthening the use of domestic resources. For such a supply oriented policy a model conception is presented in the form of a checklist of major issues to be dealt with in a comprehensive and coordinated way.

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LONG-TERM FORECASTING AND PLANNING OF THE CONSTRUCTION AND BUILDING MATERIALS INDUSTRIES

I. Introduction

By its very literal meaning already, building materials production is interlaced with building activity. It is interjacent between the exploitation of natural resources and the built-up of structures which are used for sheltering people, homing a wide range of economic activities and providing various types of infrastructural services, thus constituting basic preconditions for socio-economic welfare and development. Technical and aesthetic standards of the structures depend apart from the existence of natural resources and cultural traditions on policy objectives and priorities, skills and productivity of labor and finally on the availability and allocation of financial resources.

Historically speaking, the production of building materials together with construction constitutes one of the oldest production activities of mankind. Natural resources i.e. products of mineral and vegetal origin to be used as building materials exist at almost any place in the world and have been the object of human creativeness and innovation as well as of economic concern. As a consequence, a large variety of structures resulting from different climatic conditions, resource endowments and cultural traditions has developed all over the world.

Nowadays, where the international development debate focusses on the establishment of capital goods industries and technology development in the Third World it should not be overlook-

ed that, in a large sense- built structures are prominent capital goods and building materials their respective inputs. Furthermore, in construction, both the product and the production process avail themselves for a wide range of alternative technologies including great flexibilities in adaptation. Finally, all countries of the world dispose of traditional technologies in this area availing themselves for further development. Unfortunately these technologies very often are neglected due to a belief in the superiority of so-called "modern" imported and expensive technologies often ill-adapted to prevailing conditions. Any systematic approach dealing with long-term demand and supply of building materials has to bear in mind this general context because it (i) lays the foundation for better understanding the long-term construction and building materials production process, (ii) broadens the politicians view with respect to the specific conditions prevailing in their respective countries, and (iii) provides them with basic criteria for strategic decision- making.

II. The Need for Improved Forecasting and Planning of the Building Materials Industries

In general, there are various reasons for the particular significance of a careful programming of the building materials industry. Furthermore, experiences in many coun- tries provide sufficient evidence that there is as well a large scope for the improvement of forecasting and pro- gramming in terms of both methodology and application.

Among those reasons, one major factor is the outstanding role this sector plays together with the strongly tied construc-

tion activity in the development process. A second consists of the gap between needs and effective demand in construction and its impact on building materials requirements, i.e. the fact that in many countries for a large portion of the population decent shelter cannot be provided in economical terms. A third major reason stems from distortions between construction and building materials demand and limited capacities to supply these resources domestically.

On the other hand, the scope for improvement refers in particular to the following problems experienced in many countries not only in the Third World. First, there is apart from deficiencies in the statistical data system a considerable lack of systematic forecasting and planning of demand and supply of construction and in particular of building materials, the latter even in indutrialized countries. Second, in many developing countries the natural resources usable for the production of building materials are little known and if they are known, various obstacles impede upon their exploitation. In this connection, a third problem refers to the gap between indigeneous and demanded technologies and thus to the issue of appropriate technology and technology policy. Finally, various attitudes of policy-makers and institutional shortcomings ask for reconsideration and improvement for better programming construction and building materials production in the light of both internal and external resource constraints, on the one hand, and enormous and growing needs on the other.

III. The Construction and Building Materials Industries System

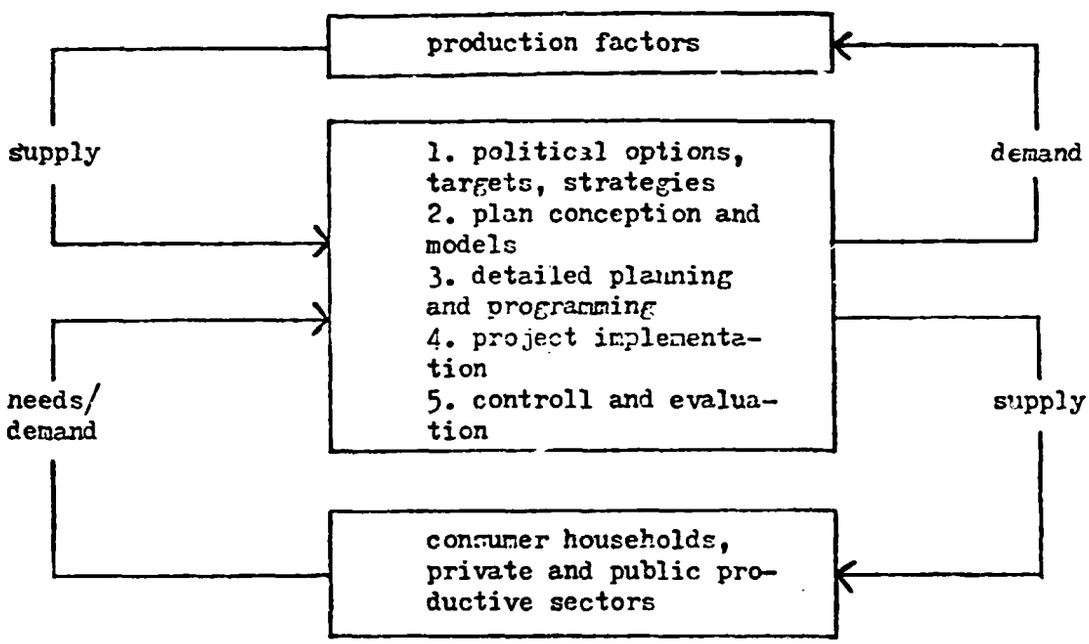
The long term development of construction and building materials production in a country is very much related to the actual and future pattern of urban and rural settlements as well as technical infrastructure needs to be interlinked with the harnessing of natural resources and with decisions on the spatial allocation of other productive resources.

In a number of countries, previous foreign domination had prevented a continuous development of available resources and their balanced exploitation and caused a distinct product specialization and spatial resource allocation pattern that disregarded domestic needs. Hence, new orientation directed towards independence and self-reliance may constitute there great challenges and imply both considerable needs and constraints for the construction and building materials industry.

The structure of activity as well as the performance and development of the construction and building materials sector depend on the quantitative and qualitative composition of the demand caused by investment decisions of the private and the public sector but also by self-help building within the informal sector. Moreover, in developing countries construction demand is particularly determined by government investment in the modern sector. Since basic needs usually exceed effective demand in Third World countries to a great extent, deliberate policy choices are required to influence the demand side. Furthermore, at this stage of development, demand and consumer needs (households and production sectors) are developing rapidly. Governments, therefore, are not only

confronted with the tasks of meeting current needs but, in particular, of anticipating future developments. The entire planning and implementation system can be seen as a dialectical process as shown in graph 1.

Graph 1: The Dialectics of the Construction Process

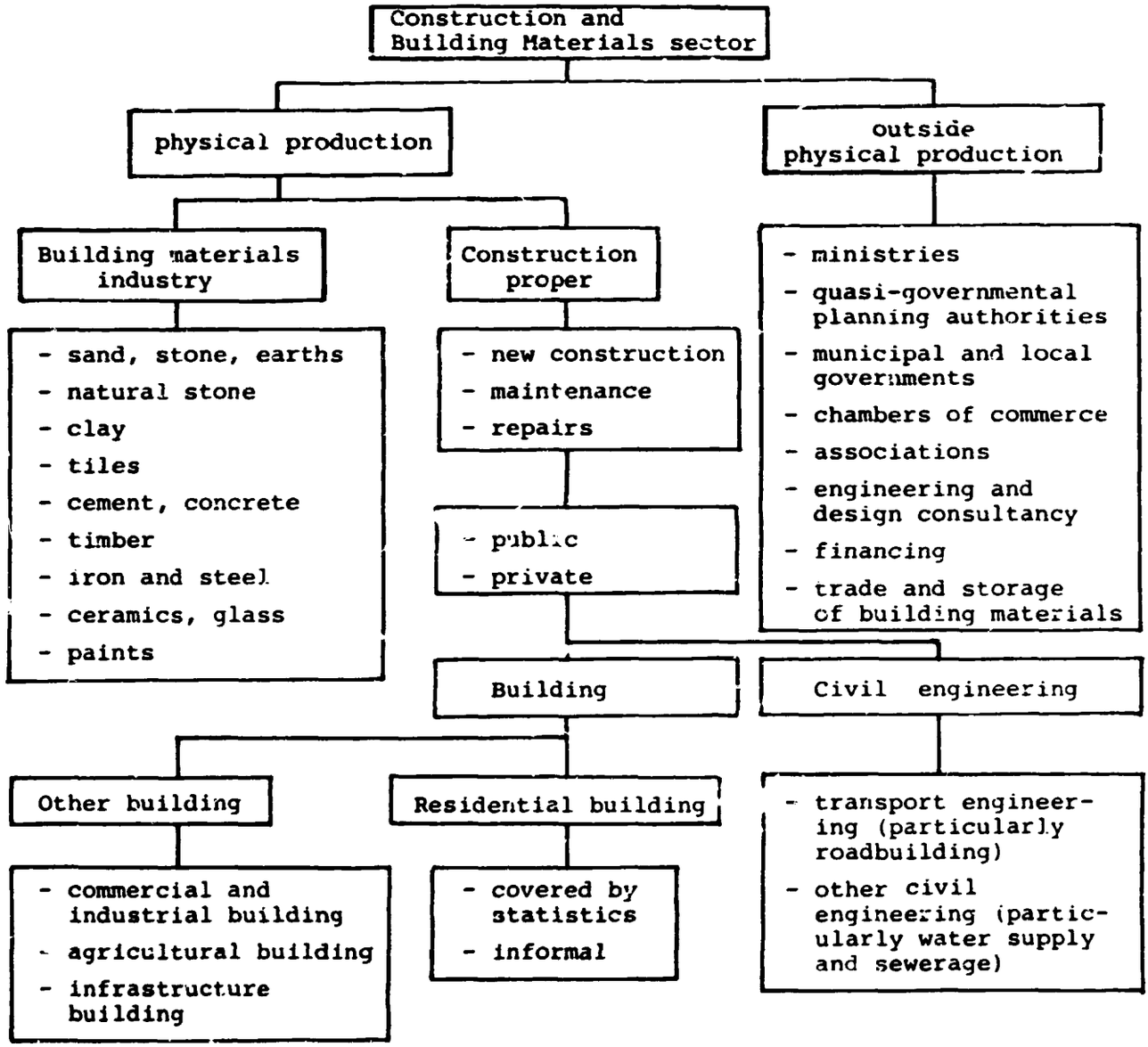


According to needs and factor supplies, political decisions about the feasible level of construction production have to be taken. Since in developing countries needs very often exceed the scarce domestic productive capacities, further decisions to increase the supply side - by importing productive resources and/or by augmenting national resources and pursuing a policy with the aim to promote domestic construction and building materials industry - are required.

Any more systematic forecasting and programming approach should conceive the building materials industry, first, as being closely linked to construction activity. Second, construction and building materials industry together should not be seen in terms of physical production only, but also in their connection with and dependencies on planning and decision-making processes which have strategic effects on the scope and orientation of physical output. Third, such an approach should take into consideration the relationships and interests of all those various actors being involved in this sector's planning and performance such as ministries and other public institutions, foreign and domestic engineering and design consultancies and contractors, the building materials industry and trade as well as financing institutions.

From this point of view the construction and building materials sector is understood as a comprehensive system including various interrelated subsystems as presented in concise form in graph 2. Subsystems may deal with the establishment of global political options and public decision-making processes as well as with very concrete problems, such as supplying a construction site with building materials. It encompasses the needs of the population for shelter and effective demand for housing as well as problems of promoting domestic construction and building materials industry.

Graph 2: The Structure of the Construction and Building Materials Sector



Source: J.Riedel, S. Schultz, Bauwirtschaft und Baustoffindustrie in Entwicklungsländern, München 1978, p. 232.

IV. Preconditions for Forecasting and Planning

1. The General Context: Inventories and Scenarios

A first stage, and in fact a prerequisite to any further well conceived planning process, is (a) an inventory and assessment of present and future needs, and (b) the establishment of an inventory of (i) actual resource endowments, (ii) their potential for development, and (iii) the estimation of their future evolution in response to alternative policy scenarios. The determination of alternative scenarios - being either more utopian or more operational - depends on development orientations and options i.e. political decision making-about general socio-economic issues, as well as on the development potential of the construction and building materials industry. As described in graph 3, this scenario formulation can be interpreted as a first step - a first sectoral subsystem - within the entire sector-system which in its turn needs to be incorporated into a global political planning system including all other sectors and their subsystems.

The sector-subsystem scenario formulation has two inputs: information (i) on construction and building materials resources and (ii) on needs for construction. The planning system produces alternative scenarios for long-term development of the sector out of which one is to be selected and included in a national development plan covering a fixed period. A model for the types and scope of information required to feed this planning system has been published by the United Nations.[1)]

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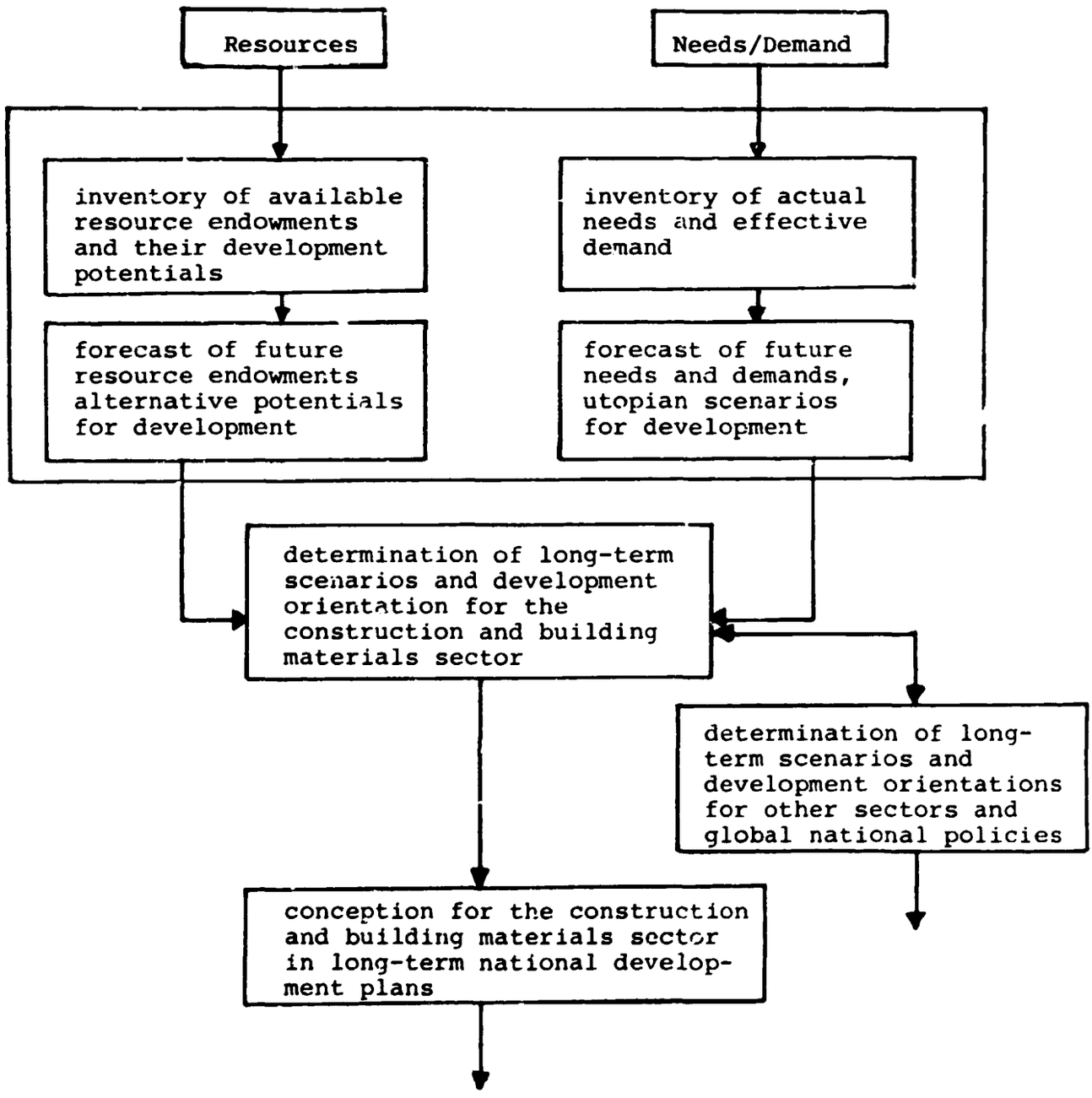
1) UN World Housing Survey, 1974, New York, 1976, p 11.

Graph 3: Planning System of Inventories and Scenario Formulation for Construction and Building Materials Industries - First Sectoral Subsystem



As can be seen there, the basic information required at this planning stage refers (i) to an inventory of needs - demand side - and (ii) to an inventory of resources - supply side. As to (i), data have to be collected, first, on housing aspects such as population, land use, housing conditions, prices and subsidies and, secondly, on civil construction, such as road network, other civil construction, and social infrastructure. As to (ii) information has to be collected on: input-output data on the modern sector, the informal sector, employment, production capacities of enterprises, skills, training institutions, capacities and performance of the building materials industry, and technology. It is obvious that the efficiency of the inventories and scenarios will depend on the scope of available data and information as well as on their quality.

These inventories are aimed at providing the necessary basis for forecasting both future needs and demands (utopian scenarios for development) and future resource endowments, i.e. the potential for alternative developments. Only the combination of these two forecasts permits determining a long-term development orientation for the construction and building materials sector. In an interdependent feed-back process this sectoral scenario serves as an input to a global national scenario and is, in turn, influenced by analogous scenarios for other sectors and global national policies.

2. The Actual Situation in Developing Countries

Usually population, household, housing censuses[1] and sample surveys provide a large amount of the data required to specify housing and their respective materials needs.[2] Also information on existing technical and social infrastructure is often available. Sometimes geographical maps can be a more or less viable information source, but they are seldom up-dated. Little, however, is known about the types and standards of buildings and their conditions, nor about the quality and functioning of civil construction works. A particular bottleneck exists when it comes to detailed data on slums and squatter settlements, although they constitute a substantial segment of large urban agglomerations and provide for a large proportion of the urban population the only way to obtain shelter.[3]

Despite the fact that the supply side is not seldom ignored in developing countries[4], the importance of a well estab-

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1) Carrying out housing censuses is a relatively new venture in developing countries. Thus, data are limited and time series are practically not available.
2) The UN Centre for Housing Building and Planning has elaborated a series of indicators with the aim of identifying housing conditions and related problems, UN World Housing Survey, 1974, New York 1976, p. 42.
3) Data on the share of slum and scatter population of total urban population: ibid. p. 28 and table 48, annex II. Further indications on percentages of households unable to afford economic cost of cheapest dwelling units built and a comprehensive analysis of housing needs and effective demand as well as income and housing costs presents O.F.Grimes, jr., Housing for Low-Income Urban Families, Economics and Policy in the Developing World, A World Bank Research Publication, Washington 1976, pp. 61-81.
4) Various reasons may be given varying from simple administrative indifference to interests of the construction and building materials industry itself to avoid such an inventory.

lished resource inventory can not be overestimated. First, such an inventory may help to determine the extent to which the satisfaction of needs is restrained by limited resources and/or only by lack of effective demand, i.e. lack of purchasing power. Secondly, and in light of the generally accepted target of using domestic resources most efficiently, the supply inventory would establish whether or not the types, volumes and standards of the desired construction works and building materials could be met by capacities of domestic contractors and industries. In its programme on the promotion of domestic construction entrepreneurs in developing countries, the World Bank has established a catalogue of criteria, such as motivation, entrepreneurial skills, educational and professional background and technical qualifications, for assessing enterprises' capacities and potential. Furthermore, the World Bank has outlined some guidelines for selecting and training potential entrepreneurs.[1] Industrial surveys have provided data on the number, size, and location of existing enterprises. In addition, such surveys have supplied data on employment, national accounting, and input-output relations. Moreover, public institutions, in particular public works departments, usually keep records on enterprises. Such records, if adequately maintained, could answer relevant questions on past performance, size of contracts, type of construction work, quality, production capacity and use of materials, meeting of deadlines, pricing, financial solidity, and creditworthiness for each contractor and building materials supplier.

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1) IBRD, A Framework for the Promotion of Construction Industries in the Developing Countries, Bank Staff Working Paper, No. 168, Washington 1973, pp. 23 and annex.

Empirical research in various developing countries has shown, however, that resource inventories in general, and records of enterprises in particular are relatively scarce or not well kept. Industrial surveys only provide very rough and aggregate data and generally neglect handicraft production and the activities of the informal sector (co-operative and self-help construction). The records maintained on enterprises by public works departments do not usually contain more than basic information, which does not permit evaluation of past performance. Because, inter alia, public records are normally out of date, the occurring loss of skill resources during and following periods of vocational and technical training make any estimation of output of skills very arbitrary.

Information on the supply and potential development of building materials is often available for products such as cement, steel and glass. But for more traditional branches like quarrying and brick-making as well as for a wide range of other manufactured products, information is rather scarce. Frequently, obsolete equipment and lack of repair, maintenance, and spare parts cause breakdowns and cut supplies, thus nourishing black markets and speculation. Such activities provoke harsh changes in supply data and invalidate most available information on material resources. This applies also to official statistics on price indexes.

The research programmes of the International Labour Organization (World Employment Programme), the World Bank, and others have established a large amount of information on alternative technologies in construction, with their respective impact on the utilization of specific types of build-

ing materials.[1] It seems, however, that these research results remain restricted to universities, international organizations and various national research institutes. Scholars may even sometimes apply the research results in small experimental pilot projects, but the research results are, in fact, not sufficiently recognized by both governments and industrialists as valuable sources of information on alternative supply factors for domestic construction and building materials.[2]

In a large number of developing countries information bottlenecks hinder the establishement of a consistent and up-dated data system, and thereby prevent sound forecasts of future resource availability, of alternative potentials for resource developments, and of future needs. Field research has shown that information requirements for long-term scenario-making are largely underestimated. As a result, decisions about basic development options for guiding national planning are like a big body without a head to think and without legs to march. Moreover, decisions about basic options are reduced to mere platitudes which are used to introduce national plans.

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1) W.P.Strassmann, Building Technology and Employment in the Housing Sector of Developing Countries, ILO-WEP, Geneva, 1975, and other papers of the author in the same programme. IBRD, Study of the Substitution of Labour and Equipment in Civil Construction, Phase I: Final Report, Washington 1971; Phase II: Staff Working Paper, No. 172, Washington 1975, and Technical Memoranda No. 1-25, Washington 1975-76.

2) This hints at a general bias against the application of domestically sourced innovations applying to other sectors as well and even to technologically advanced countries such as India. For further details see: G.Alam, J.Langrish Government Research and its Utilization by Industry: The Case of Industrial Research in India, Research Policy, Vol.13, No. 1, February 1984, pp. 55-61,and G.C.Mathur, Development and Promotion of Appropriate Technologies in the Field of Construction and Building Materials Industries in India, A Report for UNIDO, Vienna 1983, p. 29-35.

At this point the sector-subsystem "construction scenarios formulation" is interlinked with the task of formulating general and global scenarios, in as far as the above shortcomings are transferred from one system to the other and interact between the systems.

These problems, however, could be alleviated even under information constraints if global and sector scenarios were the subject of permanent high level policy deliberations which could lead to a binding co-ordinated, and consistent planning of global and sectoral policies. If at this level the interaction between the systems does not operate and decisions on the priority of construction needs, on the promotion of domestic construction and building materials industry, and on technology policies, are not taken, the risk occurs that construction is then undertaken with little regard to national needs and to the potential for the development of domestic supplies.

Decisions about construction development presume scenarios for other sectors, for instance, for rural and urban settlements for the spatial pattern of productive resource allocation, and for linking technical, economic and social activities to the communication and transport system. Almost all elements of future development include a construction component, which has to be singled out in the planning process.

Within the discussion of options and alternative scenarios, the needs and supply inventories play a key role. They provide the criteria which allow utopian scenarios to be distinguished from more feasible scenarios. They gear the discussions towards greater consideration of socio-economic reality, the specific national path of development, prevailing

constraints, and the necessity for their alleviation. These political interactions, fed by arguments of and generated from different subsystems, constitute the nourishing ground for the formulation of sound development priorities and policies, i.e. conceptions for national development plans.

Deliberation on long-term perspectives are not lacking in the Third World. A number of countries have promulgated scenarios such as: "country x in the year 2000". For various reasons, however, these scenarios are not really down to earth. One important reason is that little consideration is given to resource availabilities and constraints and this often because they are not known.

Hence, scenarios due to their lack of realistic appraisal of facts frequently prevent them from serving as a basis for valid deliberations and discussions which could give birth to sound long-term orientation and options for policy and planning. These shortcomings at this first stage of the planning process generate considerable bottlenecks in subsequent planning stages, in particular at the stage when planners engage in long-term quantified forecasting and elaborate targets for national development plans.

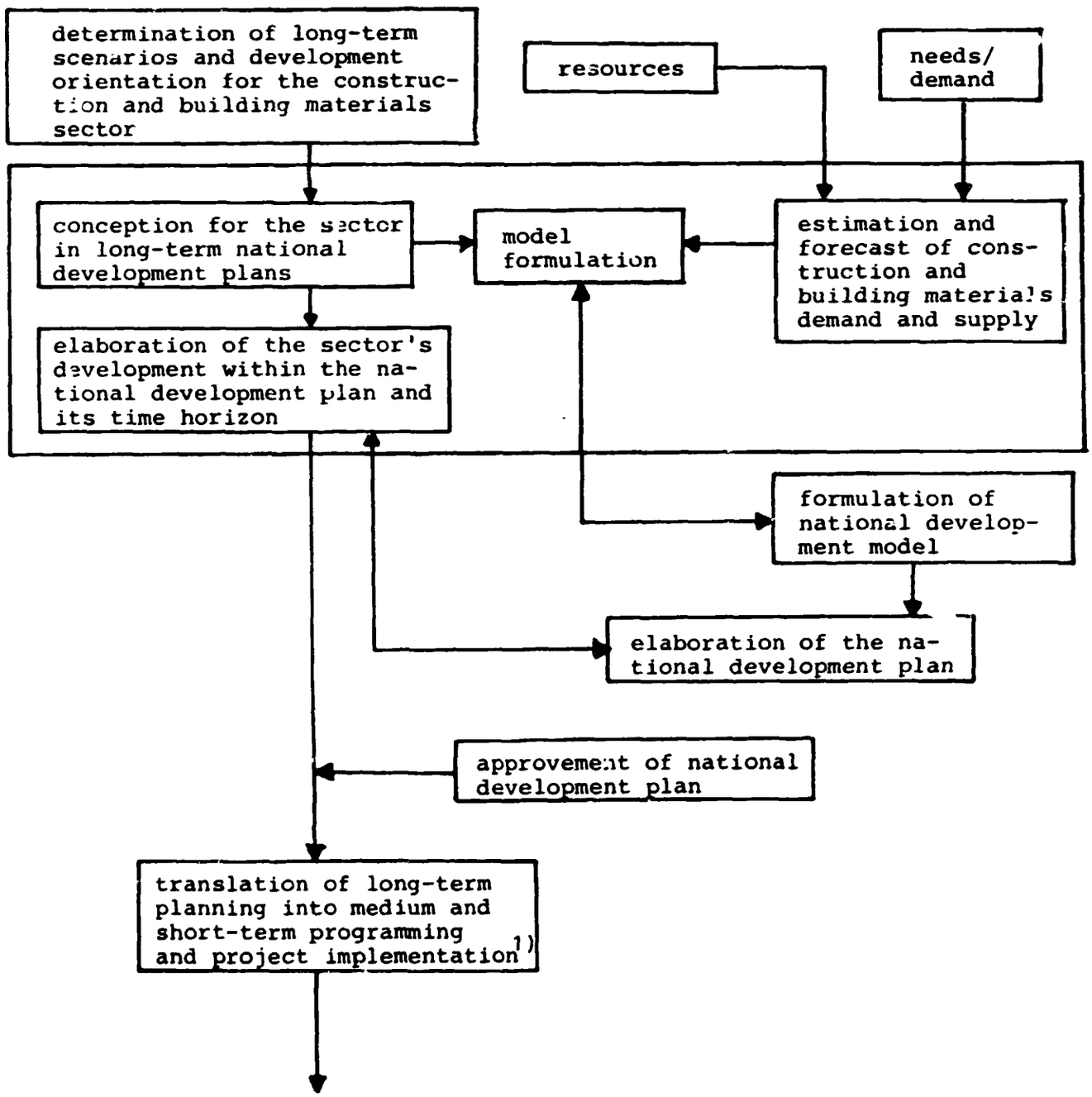
V. Long-Term Forecasting and Planning: The Construction and Building Materials Industries in National Development Plans

1. The General Context: The Planning System

At this stage of the construction and building materials planning process - we will call it the second sectoral subsystem (see graph 4) - political options and orientations are transformed into more or less quantifiable objectives and targets, thereby establishing mechanisms and instruments for achieving the development goals. In other words, scenarios are examined for their feasibility within the given plan period. After thorough research, a final choice is made. Depending on the sophistication of the model chosen and on the time and information available, a new and more intensive effort may be necessary to widen and strengthen the diagnostic basis. More detailed figures and information are likely to be required.

General planning objectives and the existing level of needs determine construction and building materials requirements. These objectives and needs, however, only generate effective demand to the extent that financial resources are available to be channelled and invested in this sector. On the other hand, existing financial resources only result in construction activity if sufficient construction capacities exist, that is, if the supply side can respond to demand within a reasonable time period unless foreign supplies are imported. Financial and other limitations must be considered in the course of the plan elaboration and be seen in light of the plans and needs of other sectors.

Graph 4: System of Construction and Building Materials Planning with Regard to National Development Plans - Second Sectoral Sub-System



1) The translation of long-term planning into medium and short-term programming and project implementation, the related problems of disaggregation and time-scheduling and the formulation and execution of respective policy measures would constitute the third sectoral sub-system of the planning process. It will not be explicitly dealt with in this paper.

The assessment of demand, and its projection, must be done in detail. Orders of magnitude for priority needs and requirements must be estimated. It is also necessary (i) to indicate the capacity limits of the (domestic) construction and building materials industry, (ii) to assess requirements for investment financing in terms of both national and foreign currency, working capital, machinery, technical equipment, manpower, skills, training, and educational facilities, and (iii) to evaluate the demand for construction materials for type and region, for potential economies of scale, and for transportation costs. In addition, special attention must be paid to the effects of government policies, i.e. trade policies, foreign exchange constraints, on the sector's ability to import on short notice equipment and materials which cannot be obtained locally.

2. Types of Demand Forecasts Used in National Development Plans

In national development plans the following approaches for forecasting and planning construction and building materials may be applied.

Macro-economic Approach

For long-term projections reference is usually made to the forecasts of gross domestic product (GDP). Research has shown that gross fixed capital formation and the construction sector's value added are correlated with the growth of gross

domestic product per capita.[1] However, the two measures do not move in step. The share of construction is relatively low at first, before accelerating when countries attain a middle income position, and then it finally stabilizes slightly higher up the scale.[2]

This approach, however, only provides global orders of magnitude and contains all the shortcomings of macro-economic methods with respect to planning and forecasting GDP.[3] Nevertheless, no better method being available, this approach is a reasonable instrument and a first step towards forecasting aggregate construction demand for medium and longer periods including the resulting building materials requirements therefrom. But further disaggregations by different types of construction works and activities, such as building and civil engineering or types of buildings and their specific requirements in terms of individual materials are necessary subsequent steps.

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1) London University College, Environmental Research Group, Building Research Unit, Construction and Development: A Framework for Research and Action, London 1972.
2) J. Riedel, S. Schultz, Bauwirtschaft ..., op.cit., pp. 6 (pp. 233 English Summary). Findings confirm earlier research of W.P. Strassmann, The Construction Sector in Economic Development, Scottish Journal of Political Economy, Vol. XVII, No. 3, Nov. 1970, pp. 391-409.
3) F. Betz, J.A. Costacurta de Azevedo, Structural Global Models and O.Helmer, Inter-disciplinary Modelling, in: C. Churchman, O. Mason, eds., World Modelling: A Dialogue, Vol. 2, Amsterdam 1976, pp. 37-47, and 73-80.

Programming Approach

In a number of developing countries regional, spatial and physical planning is undertaken and large urbanization master plans have been elaborated. Usually such plans are rather disaggregated, cover a period of several years, and may allow the identification of construction and building materials requirements. Under the condition that time schedules for implementation have been elaborated and that governments and/or other responsible public institutions have made clear commitments, considerable shares of future demand can be projected at a rather disaggregated level. Distinctions could be made for instance between (i) low-storey buildings with load bearing walls and simple foundations, (ii) high-storey buildings with structural steel-works, reinforced concrete, and complex foundation requiring large-scale excavations, (iii) various types and levels of road construction and (iv) bridges, dams, irrigation, land reclamation and canalization works, water supply, sewerages and airport and harbour facilities.

Project Approach

In recent years, a number of developing countries have shifted priorities from macro-approaches to project planning. Macro-models are supplemented by project lists and techniques of project planning and budgeting systems (PPBS) are used. Depending on classifications applied within the computer programming system, the construction component disaggregated by individual projects, by locality, etc., may be identified in advance. This calculated construction component may account for a considerable portion of the total construction demand.

It should be remembered that the results of the application of the three forecasting approaches discussed above rest on the assumptions (a) that demand will follow more or less a path similar to past developments, and (b) that governments will implement planned programmes and projects according to their commitments and time schedules. Two additional factors also have to be taken into account: (i) the latter two projection approaches are largely public and planning oriented, thus excluding private construction and in particular the informal sector, which constitutes an important share of construction activity and building materials production in developing countries, and (ii) in view of supply constraints the forecasted demand should be carefully examined in light of existing productive facilities. This means that demand must be specified and disaggregated as far as possible with respect to technical, professional, and financial requirements and production capacities.

All three forecasting approaches nave their significance and if integrated may altogether provide a sound foundation for a coordinated down- und upstream planning process leading towards more consistency and operationality. The programming and project approaches, however, have the disadvantages (i) to be more short- and medium-term and less long-term oriented and (ii) to focus on public activities and larger projects by neglecting the multiplicity of smaller projects carried out by the private sector. Since the latter, relating mainly to building and housing, is particular by intensive in materials consumption such a bias would even create a larger impact on the forecast of building materials demand. On the other hand, the macro-economic approach apart from its comprehensive nature has the advantage of displaying the sector's growth lim-

itations with respect to available resources and a balanced development pattern. In other words, it can provide both the framework into which programmes might be fitted and orientation for policy makers to keep control over resource allocation. Keeping in mind these aspects, there is sufficient evidence in developing countries on the needs to establish or to improve forecasting and planning of the construction and building materials industry. This refers mainly to the macroeconomic approach and in particular to its disaggregation because in many countries this is the missing link to the programming and project approaches. In the following, therefore, an effort will be made to establish suggestions for improving the actual situation, by focussing on long-term approaches.

VI. Long-Term Forecasting of Construction and Building Materials Demand: A Step by Step Approach towards Disaggregation

1. Some Key Indicators of the Sector's Structure

During the last two decades the construction sector collectively accounted for 5 to 6 % in developing countries' gross domestic product (GDP)[1)] and employment whereas the GDP-ratio went up to 8 % in industrialized countries. On Third World average the value added ratio in the construction sector has been estimated at 51 % i.e. gross production is made up in roughly equal parts of inputs from other sectors and own value added (chart 5). Just over a quarter of gross output goes in wages and salaries, the rest is depreciation, interest, rent and profits.

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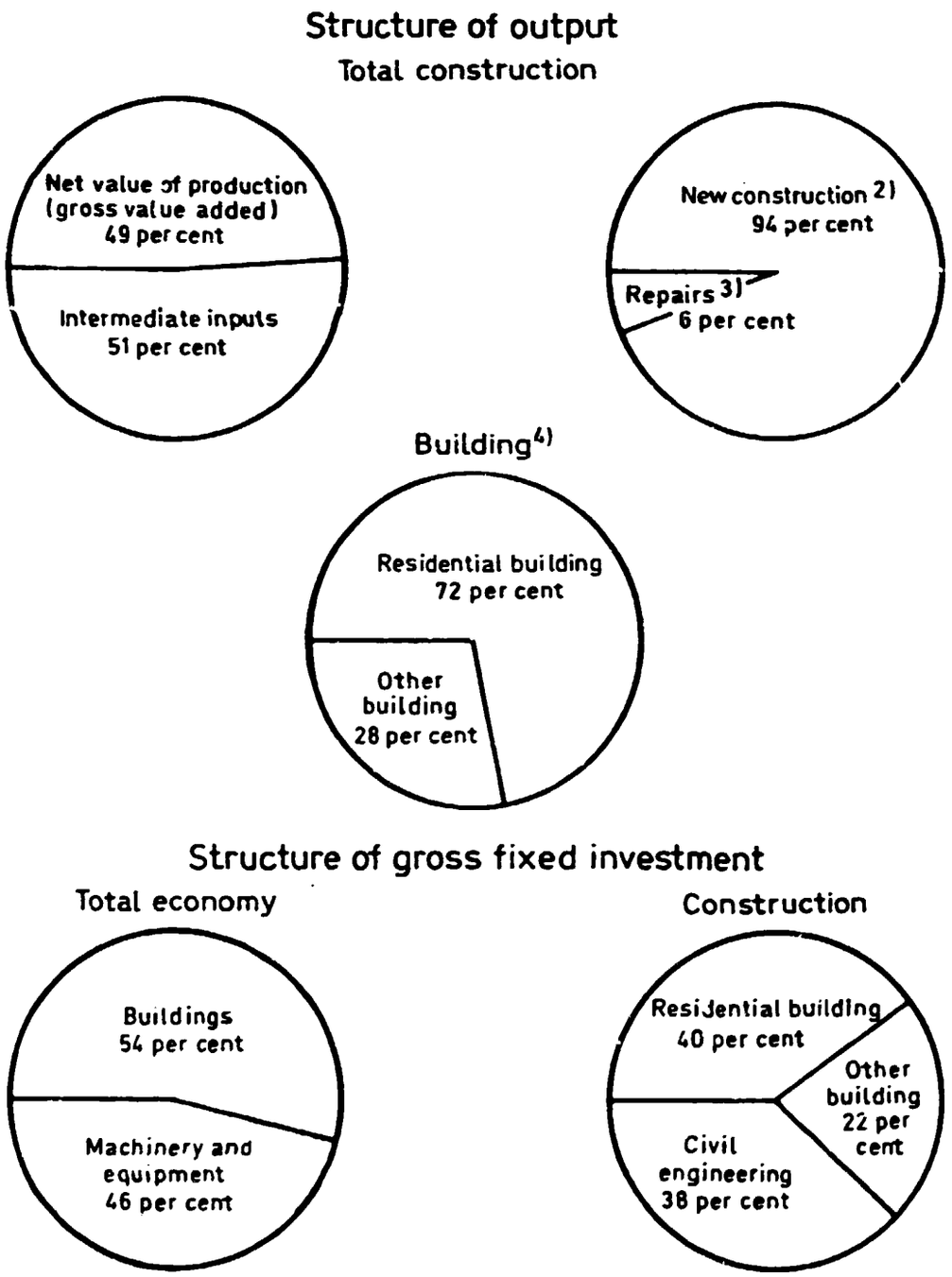
1) In many countries this ratio is considerably higher, see table 1.

STRUCTURAL DATA OF CONSTRUCTION IN DEVELOPING COUNTRIES [1] 1970 TO 1974

Graph 5:



1) *Average figures for the countries covered by the UN statistics under that particular heading.* — 2) *Including capital repairs.* — 3) *Current repairs and maintenance.* — 4) *Completed m².*

Sources: UN, Yearbook of Construction Statistics 1965 - 1974, New York 1976; UN, World Housing Survey 1974, New York 1976. UN, Compendium of Housing Statistics 1972-74, New York 1976.

reprinted from: J.Riedel, S.Schultz, op.cit., p. 236.

Hence, the sector is an important distributor of growth stimuli to other sectors, in particular to those industrial branches producing construction materials, due to its large requirements for intermediate inputs (backward linkage effects), thus constituting a so-called leading sector in economic development (see table 1).

Table 1 Average Ranking Position of Construction within 20 Economic Sectors

Criteria	Average Position[a] in		
	Africa (13)[b]	Asia (13)	Latin America (8)
Linkage effects			
- direct unweighted			
forward	4,5	4,4	6,9
backward	11,0	17,1	14,3
- direct weighted[c]			
forward	3,4	3,1	4,9
backward	7,3	13,8	13,4
- total[d]	4,2	4,4	7,7
contribution to			
- GDP	7,6	9,4	7,9
- wages and salaries	2,5	3,5	2,4
- imports	7,6	9,4	7,9
- employment	5,0	7,2	5,1

a) small value = high ranking = important effect (for import contribution: high ranking = small effect), - b) number of countries, - c) weighted by share of sectoral production in total value of production,
d) direct and indirect effects induced by one unit of final demand.

Source: J. RIEDEL and S. SCHULTZ, op.cit., pp. 42-58.

On an average from a sample of 34 countries, major building materials are supplied from the sectors non-metallic minerals, basic metals and metal products, wood and wood products as well as mining and quarrying (see table 2) which, however, sell only part of their products to construction. In addition, trade, transport and other services receive as well important orders from construction.

14 major building materials are specified in table 4 and ranked according to Developing Market Economies' shares in world imports and exports. The average import of intermediate inputs for the construction sector in a group of countries investigated is about 10 per cent of all imports of intermediate inputs; the share of total imports is about 5 per cent.[1] The import share of individual product groups in construction input - the par. of domestic consumption which originates from abroad - can vary virtually from zero to 100 per cent. There is no cause for concern about an article being entirely imported so long as its share, measured by the construction sector's total imports, is small. The figures for import intensity calculated to measure the (product- and country-specific) burden show up the iron and steel sector and its manufactured products as a general bottleneck area. There appears to be a link with the level of development: in particular the import of high-value finished manufactures (constrution machinery) makes very little impact in some threshold countries because domestic supplies have become relatively ample.

Cor uction together with building materials play an important role in gross fixed capital formation (GFCF) to which the sector contributes 54 %. On an average construction investment comprises 40 % residential building, 22 % other building and 38 %

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1) J.Riedel, S. Schultz, op.cit., pp. 34-40.

Table 2: Domestic Purchases of Construction from Other Sectors - Shares of Supplying Sectors

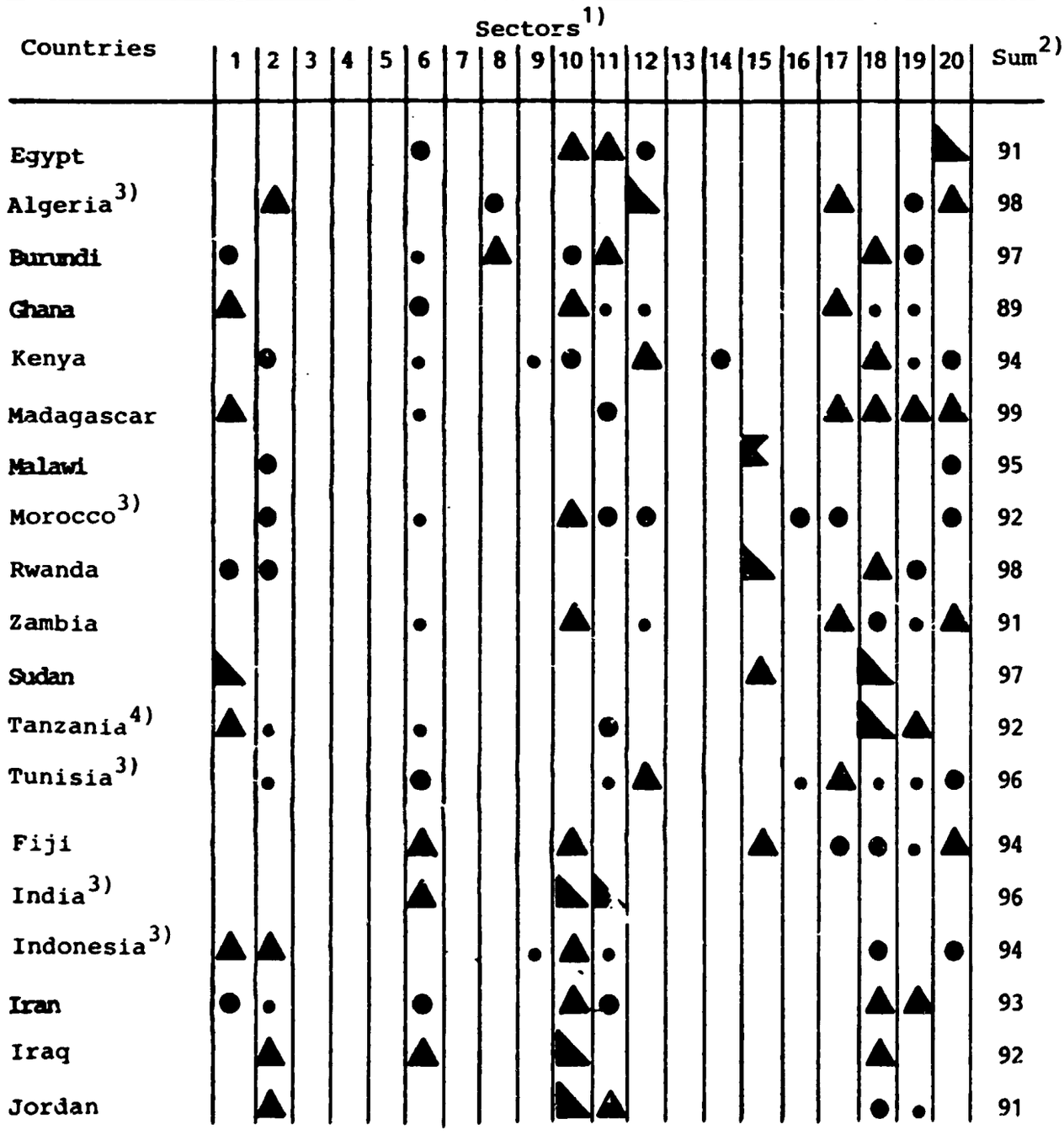
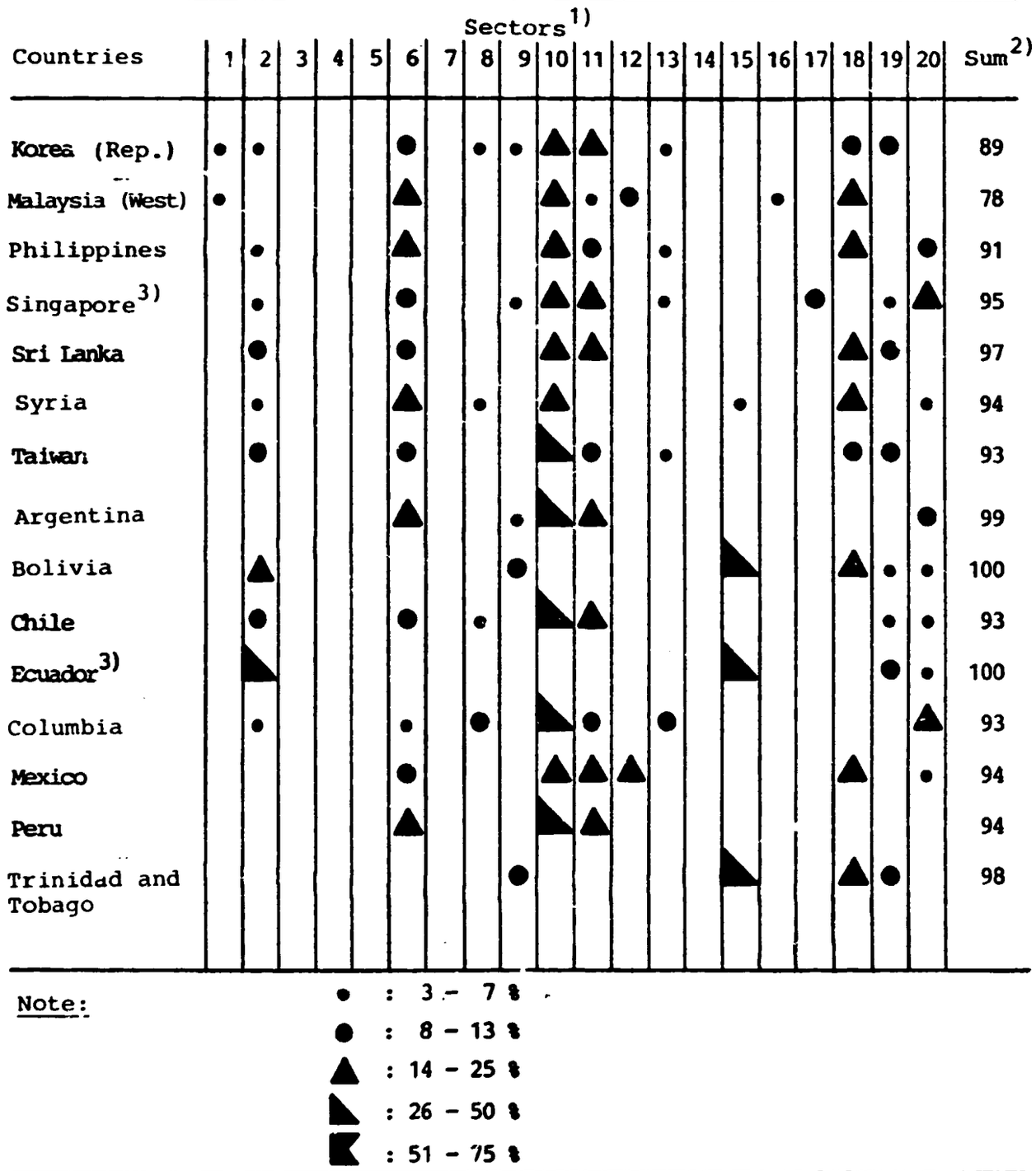


Table 2: (cont.)



1) For sector definition see table 3.
2) Sum of indicated shares in %.
3) Imported supplies included.
4) Sansibar excluded.

Source: J.Riedel, S.Schultz, op.cit., pp. 56-57.

Table 3: Economic Sectors (UN-Classification)

Nr.	Sector	I S I C [1]	
		1958[2]	1968[3]
1	Agriculture, Forestry, Fishing	01-04	11-13
2	Mining and Quarrying	11-14, 19	21-23, 29
3	Food, Beverages, Tobacco	20-22	31
4	Textile, Weaving Apparel	23, 24	32 ./. 323
5	Leather	29	323
6	Wood, Furniture, Paper, Printing, Publishing Products	25-28	33, 34
7	Rubber	30	355
8	Chemical, Plastic Products	31	351, 352, 356
9	Petrochemicals	32	353, 354
10	Non-metallic minerals	33	36
11	Basic Metals, Metal Products	34, 35	37, 381
12	Non-Electrical Machinery	36	382
13	Electrical Machinery	37	383
14	Transport Equipment	38	384
15	Others	39	385, 39
16	Electricity, Gaz, Water	51, 52	41, 42
17	Construction	40	50
18	Trade	61	61, 62
19	Transport, Storage, Communication	71-73	71, 72
20	Other Services	62-64, 81-85	63, 81-83, 91-94, 951-953, 959
21	Non defined	90	00

1) International Standard Industrial Classification of All Economic Activities.

2) UN, Statistical Papers, Series M, No. 4, Rev. 1.

3) UN, Statistical Papers, Series M, No. 4, Rev. 2, Add. 1.

Table 4 : Ranking of 14 Major Building Materials According to Developing Market Economies' Shares (1979) in World Imports and Exports and their Growth 197o - 1979

Product groups	SITC	Ranking			
		Import shares 1979	Import growth 197o/79	Export shares 1979	Export growth 197o/79
Wood rough	242	12	7	1	1o
Wood shaped	243	13	12	4	9
Plywood veneers inlaid.	63121	8	1	2	8
Wood simply worked	6318	14	14	5	12
Builders wood work prefab.	6324	9	3	6	2
Stone, sand and gravel	273	11	6	7	4
Ciment	6612	1	5	3	14
Clay, refractory building prod.	662	6	1o	12	6
Glass	664	7	4	1o	5
Iron steel primary forms	672	3	8	9	7
Iron and steel shapes	673	2	2	11	11
Iron steel universals plates and sheets	674	5	9	13	3
Steel, copper nails, nuts screws, bolts etc.	694	1o	13	8	1
Pigments, paints	533	4	11	14	13
Total Unweighted average (14 product groups)		24,1 %	35,1 %	16,2 %	26,6 %

Source: UN-Yearbook of International Trade Statistics, 1979.

civil engineering[1)], whereby the building materials component differs by type of works in terms of both volume and structure.

The above indicators represent average orders of magnitude behind which considerable country-wise deviations are hidden. These deviations may be due to accrued financial ressources (OPEC-countries in the seventies) or to particularly high needs in terms of infrastructure and housing or simply linked to levels of economic development. The indicators (ratios), therefore, cannot serve as bases for programming construction and building materials demand in individual countries. Instead, the forecasting and programming in this area is rather and moreover has to be based on country-specific - features such as resources and needs and on individual governments' policy priorities.

2. Factors Determining Demand Forecasts

In principle the demand for building materials depends on the volume of construction activity which itself is strongly related to overall economic performance as quantified by gross domestic product (GDP) and gross fixed capital formation (GFCF). A strong correlation has been identified between GDP and both value added of construction (graph 6) and the construction component of GFCF (graph 7) measured in per capita values. Furthermore, research findings show that the share of construction activity in gross domestic product depends on

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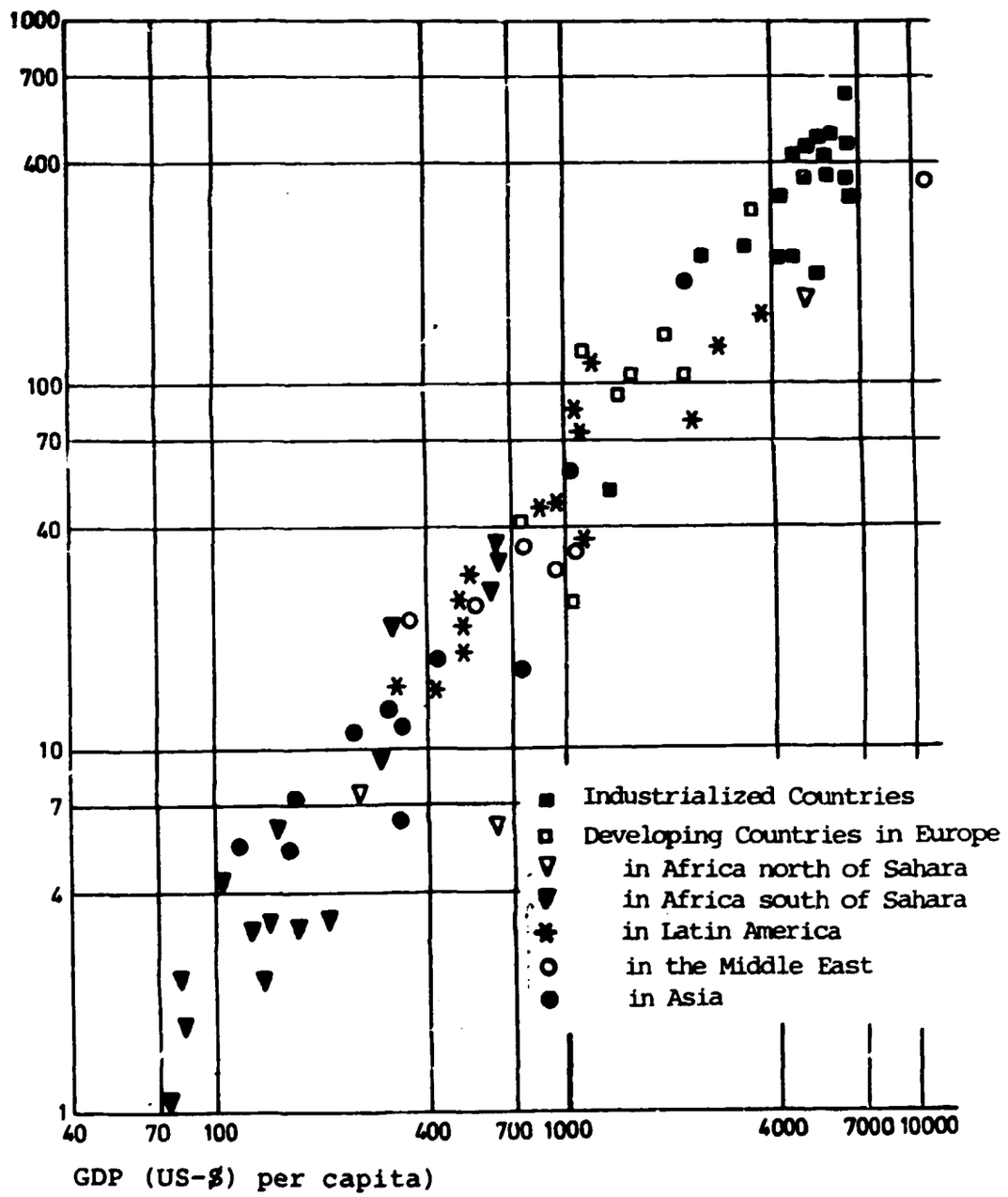
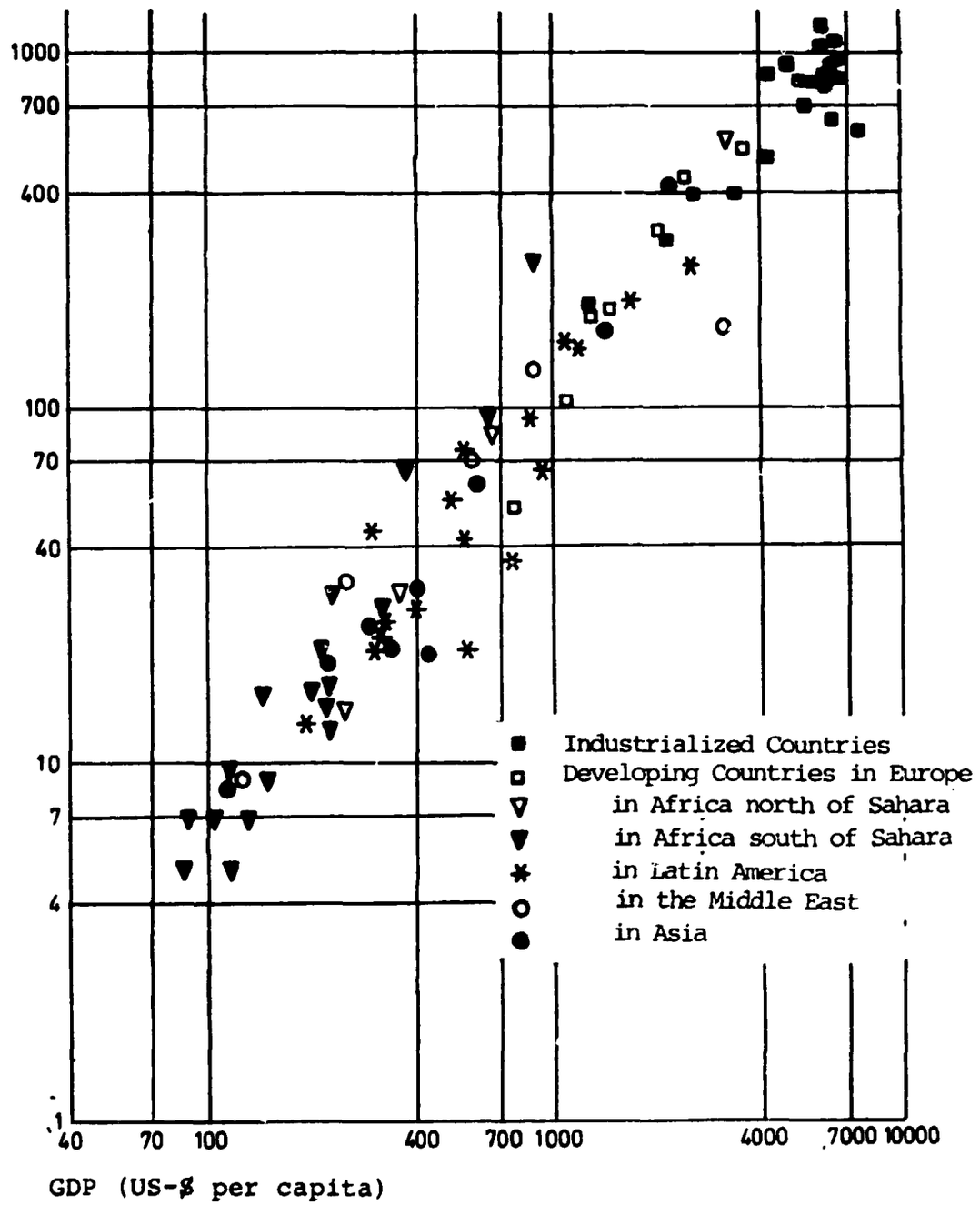
1) In another source estimations range from 35 to 40 %, 22 to 27 % and 35 to 38 % respectively. F.Moavenzadeh, F.Hagopian, Construction and Building Materials Industries in Developing Countries MIT, Cambridge, Mass., August 1983, pp. 9-10.

Graph 6: Net Production Value of Construction and GDP (1972 through 1974)
Per-Capita-Values, Logarithmic Scale



Sources: UN, Yearbook of Construction Statistics 1965-1974, New York 1976; UN Monthly Bulletin of Statistics, various issues; UN Yearbook of National Accounts Statistics 1975, Vol. I and II, New York 1976; IMF, International Financial Statistics, various issues.

Graph 7: Gross Construction Investment and GDP
(1972 through 1974)
Per-Capita-Values, logarithmic scale



Sources: UN, Yearbook of National Accounts Statistics 1975, Vol. I and II, New York, 1976; UN Monthly Bulletin of Statistics, various issues; IMF, International Financial Statistics, various issues.

the level of development, measured in per capita income. However, the two measures do not move in step. The share of construction is relatively low at first before it accelerates in the middle income groups. In threshold countries, it stabilises slightly higher up the scale (graph 8).

There are no similar correlations between the level of GDP and the total consumption of building materials because (i) they are difficult to quantify due to a lack of precise definition of this industry and (ii) they would make less sense at this level of aggregation. The structure of construction both at global average and country-specific level and its effects on materials consumption very likely will affect such a ratio more than the level of GDP. There is, however, empirical evidence, that the share of infrastructure in total construction demand will decline during the development process against growing shares of industrial building and further residential dwellings at higher GDP levels.[1)] Due to the higher materials consumption intensity of building this tendency will create an increasing demand elasticity for materials related to total construction.

In addition to construction and its composition, the demand for building materials is affected by the technology applied in terms of both product and process technology. Whereas in the past the technology issue was mainly discussed with respect to process technology i.e. capital versus labor intensity (research programmes of ILO and IBRD), in recent years the topic seems to move towards the use of foreign versus domestic materials (product technology) in the light of grow-

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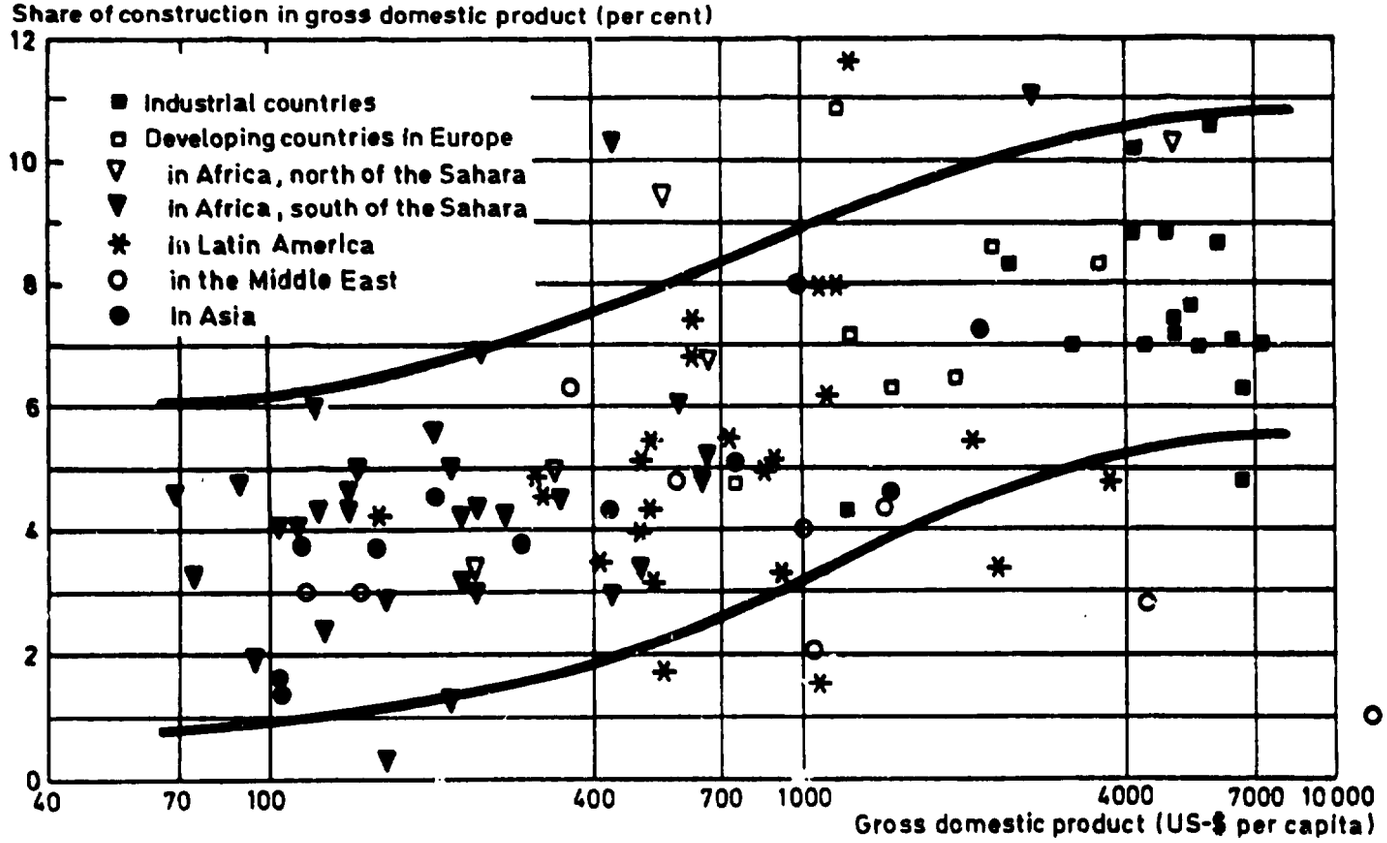
1) D.Wheeler, Major Relationships Between Construction and National Economic Development, MIT, Cambridge, Mass., 1982.

Graph 8:

THE CONTRIBUTION OF CONSTRUCTION TO GROSS DOMESTIC PRODUCT AND PER-CAPITA INCOME IN 1974

semi-log scale



Sources: UN, Yearbook of National Accounts Statistics 1975, Volumes I and II, New York 1976; UN, Monthly Bulletin of Statistics, various issues; IMF, International Financial Statistics, various issues.

ing foreign currency constraints. There is, however, usually a link between process and product technology in the sense that the technical standards decided for a structure including the technical specifications of materials to be built in largely determine the labor and capital content of the construction process; i.e. with a rise of product technology the capital intensity tends to grow apart from increasing skill and financial requirements. Thus, the future demand will depend on technology changes in construction as well as in building materials production. Other factors affecting demand are the availability and prices of building materials, which in turn depend on consumption trends, demand elasticities, product substitution potentials, as well as government policies with respect to price regulation, subsidies, supply and distribution, exporting and importing. The high foreign debt burden of many developing countries and necessities to save energy is and will very likely continue stimulating such policies and give these factors a particular weight in construction and building materials demand.

In this context on might miss the growth of population, particularly in urban areas, as a leading indicator for and positively related to construction and building materials demand. Keeping in mind, however, the afore-mentioned close relationship between this sector and GDP and GFCF per capita (i.e. GDP and GFCF divided by total population), it becomes clear that within a constant GDP level a higher population growth tends to lower construction demand and activity. This development paradox reminding of the "vicious circle" theorem in fact identifies a widening gap between needs which are increasing in line with population growth and urbanization etc. and the (effective) demand which is derived from the private and public household's ability (income) and willingness to

pay for construction facilities.[1] Thus, needs qualify for a potential demand only, whereas GDP and GFCF are the resources to identify effective demand.

3. Demand Forecasting Methods

In this chapter various long-term forecasting methods are presented and assessed according to their usefulness and validity.

The Direct Macro-Economic Approach consists of forecasting the demand for building materials directly as a function of GDP and/or GDI (exogenously forecasted independent variables)[2] according to previous trends by applying either simple regression or/and input-output analysis. This approach preconditions that statistics (time series) are available isolating the building materials component from the total industries production of respective sectors. This is usually not the case and input-output-tables can hardly remedy for this because they are not sufficiently detailed and only elaborated from time to time i.e. not on an annual basis. Furthermore, findings among other constraints would be highly aggregated,

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1) For further analysis of these aspects including the role of savings and income distribution, see: F.Moavenzadeh, F.Hagopian, op.cit., pp. 102-117.

2) Significant relationships though at varying degrees have been found for major building materials such as cement, steel, sawnwood, sawn softwood, wood panels and plastics using polynomial regression (first and second order polynomial regression equations) in the form of $\log y = a \log x + b$ or $\log y = c \log x - d (\log x)^2 + e$.
T.O'Brien, D.A. Turin, Building Materials Industries - Factors Affecting Their Growth In Developing Countries, A monograph prepared for UNIDO, University College Environmental Research Group, London 1969, Chapter B and Annex 1.

and assume a constant share of construction volume in GDP and GFCF respectively, thus hardly being able to serve as a realistic and operational tool for public programming and entrepreneurial decision-making.

A first methodical improvement can be achieved through the utilization of the Indirect Macro-Economic Approach by which first the total construction volume is forecasted on the basis of GDP and/or GFCF. Then, in a second step, the overall building materials requirements are estimated as a function of total construction demand. Though this method takes into account possible changes in the shares of construction in GDP and GFCF which may be due to government priorities or large construction investment programmes no provisions can be made for future variations in the structure of total construction volume. Moreover, no criteria can be developed to subdivide the overall building materials demand into product groups or individual products. Efforts, however, have been made to overcome these difficulties by applying macro-economic models and input-output tables.[1)]

Hence, in order to establish an operational forecasting system Indirect Disaggregated Approaches have to be established, i.e. prior the assessment of future building materials requirements by product groups or even individual products, future construction demand has to be differentiated by kind of work. The degree of specification to be decided upon has to be seen in the light of available statistics and information access as well as the cost for supplementary data collection.

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1) CMT, Role and Contribution of the Construction Industry to Socio-Economic Growth of Developing Countries, Cambridge, Mass. 1982, Chapter VI and Appendix 1.

On the international level, the following two types of classifications have been agreed upon and avail themselves for application:

(i) Indexes to the International Standard Industrial Classification of all Economic Activities, United Nations Series M, No. 4, Rev. 2, Add 1, New York, 1970

ISIC-Code 5000 Construction

GENERAL AND SPECIAL TRADE CONTRACTORS PRIMARILY ENGAGED IN CONTRACT CONSTRUCTION. ALSO INCLUDED ARE UNITS OF ENTERPRISES PRIMARILY ENGAGED IN CONSTRUCTION WORK FOR THE PARENT ENTERPRISE WHICH CAN BE SEPARATELY REPORTED.

GENERAL CONTRACTORS MAY BE ENGAGED IN CONSTRUCTING, ALTERING, REPAIRING AND DEMOLISHING BUILDINGS; CONSTRUCTING, ALTERING AND REPAIRING HIGHWAYS AND STREETS AND BRIDGES; VIADUCTS, CULVERTS, SEWERS, AND WATER, GAS AND ELECTRICITY MAINS; RAILWAY ROADBEDS, SUBWAYS, HARBOURS AND WATERWAYS; PIERS, AIRPORTS AND PARKING AREAS; DAMS, DRAINAGE, IRRIGATION, FLOOD-CONTROL AND WATER-POWER PROJECTS AND HYDROELECTRIC PLANTS; PIPELINES; WATER WELLS; ATHLETIC FIELDS, GOLF COURSES, SWIMMING POOLS AND TENNIS COURTS; COMMUNICATION SYSTEMS, SUCH AS TELEPHONE AND TELEGRAPH LINES; MARINE CONSTRUCTION, SUCH AS DREDGING AND UNDERWATER ROCK REMOVAL; PILE DRIVING, LAND DRAINING AND RECLAMATION; AND OTHER TYPES OF HEAVY CONSTRUCTION. BUSINESSES PRIMARILY ENGAGED IN PERFORMING MINING SERVICES, SUCH AS PREPARING AND CONSTRUCTING MINING SITES AND DRILLING CRUDE OIL AND NATURAL GAS WELLS, ON A CONTRACT OR FEE BASIS, ARE CLASSIFIED IN THIS GROUP.

SPECIAL TRADE CONTRACTORS ARE ENGAGED IN ONLY PART OF THE WORK OF A CONSTRUCTION PROJECT. SPECIAL TRADE CONTRACTORS MAY WORK ON SUBCONTRACT FROM THE GENERAL CONTRACTOR OR DIRECTLY FOR THE OWNER. THEY MAY ENGAGE IN SUCH ACTIVITIES AS PLUMBING, HEATING AND AIR-CONDITIONING INSTALLATION; BRICK-LAYING, STONE SETTING, TILE SETTING, MARBLE AND STONE WORK; CARPENTRY; FLOOR-LAYING; PLASTERING AND LATHING; ROOFING; CONCRETE WORK; PAINTING AND DECORATING; SHEET METAL AND ELECTRICAL WORK; WATER WELL DRILLING; STRUCTURAL STEEL ERECTION; EXCAVATING AND FOUNDATION WORK; WRECKING AND DEMOLITION WORK; AND REPAIR AND MAINTENANCE WORK ON BUILDINGS. HOWEVER, MAINTENANCE OR REPAIR WORK DONE BY MAINTENANCE STAFFS IN THE FULL-TIME EMPLOY OF THE UNITS, THE PREMISES OF WHICH ARE BEING REPAIRED, ARE EXCLUDED.

THE ASSEMBLY AND INSTALLATION ON THE SITE OF PREFABRICATED, INTEGRAL PARTS INTO BRIDGES, WATER TANKS, STORAGE AND WAREHOUSE FACILITIES, RAILROAD AND ELEVATED RIGHT-OF-WAY, LIFT AND ESCALATOR, PLUMBING, SPRINKLER, CENTRAL HEATING, VENTILATING AND AIR-CONDITIONING, LIGHTING AND ELECTRICAL WIRING, ETC. SYSTEMS OF BUILDINGS, AND ALL KINDS OF STRUCTURES, IS A CONSTRUCTION ACTIVITY. DEPARTMENTS OR OTHER UNITS OF THE MANUFACTURERS OF THE PREFABRICATED PARTS AND EQUIPMENT WHICH SPECIALIZE IN THIS WORK AND WHICH IT IS FEASIBLE TO TREAT AS SEPARATE ESTABLISHMENTS, AS WELL AS INDEPENDENT BUSINESSES PRIMARILY ENGAGED IN THE ACTIVITY, ARE CLASSIFIED IN THIS GROUP.

AEROPLANE HANGAR CONSTRUCTION

AIR-CONDITIONING SYSTEM INSTALLATION

AIR-CONDITIONING SYSTEM REPAIRING
AIRPORT CONSTRUCTION
AQUEDUCT CONSTRUCTION
ATHLETIC FIELD CONSTRUCTION
BAILING OIL WELLS, CONTRACT SERVICES
BARN, ALUMINIUM, CONSTRUCTION
BARN, CONSTRUCTION, WOODEN
BOILER INSTALLATION
BREAKWATER CONSTRUCTION
BRICKLAYING
BRICKLAYING REPAIR WORK
BRIDGE CONSTRUCTION
BROADCASTING STATION CONSTRUCTION
BUILDING CONSTRUCTION
BUILDING DEMOLITION
BUILDING MAINTENANCE, NOT INCLUDING JANITORIAL AND SIMILAR SERVICES
BUILDING REPAIR WORK
CABLE LAYING
CANAL CONSTRUCTION
CARPENTRY
CASING OIL WELLS, CONTRACT SERVICES
CEMENTING OIL WELLS, CONTRACT SERVICES
CESSPOOL CONSTRUCTION
CHANNEL CONSTRUCTION
CHEMICAL PLANT CONSTRUCTION
CHIMNEY BUILDING AND REPAIRING
CLEANING OIL WELLS, CONTRACT SERVICES
COAL MINE, SHAFT SINKING, CONTRACT SERVICES
CONCRETE REPAIR WORK
CONSTRUCTION, EXCLUDING ANCILLARY ACTIVITY BY ESTABLISHMENTS CLASSIFIED IN OTHER ISIC GROUPS
CULVERT CONSTRUCTION
CULVERT DEMOLITION
CUTTING CASINGS, TUBES AND RODS, GAS AND OIL WELLS, CONTRACT SERVICES
DAM CONSTRUCTION
DERRICK CONSTRUCTION FOR OIL AND GAS WELL
DEVELOPING NON-METALLIC MINERAL MINES EXCEPT COAL, PETROLEUM, STONE, CLAY AND SAND, CONTRACT SERVICES
DIAMOND MINE DEVELOPING
DIKE, FOR POWER DEVELOPMENT, CONSTRUCTION
DIKE, FOR RIVER CONTROL AND NAVIGATION, CONSTRUCTION
DISTRIBUTION LINE CONSTRUCTION
DISTRIBUTION STATION AND SUBSTATION CONSTRUCTION
DOCK CONSTRUCTION
DRAINAGE ON CONSTRUCTION PROJECT
DRAINAGE SYSTEM CONSTRUCTION, NOT OPERATION
DREDGING COAL MINE, CONTRACT SERVICES
DREDGING ON CONSTRUCTION PROJECTS
DRILLING GAS WELL, CONTRACT SERVICES
DRILLING OIL WELL, CONTRACT SERVICES
DRILLING WATER INTAKE WELL, CONTRACT SERVICES
DRIVEWAY CONSTRUCTION
DYKE CONSTRUCTION
ELECTRIC RAILWAY ROADBED CONSTRUCTION
ELECTRIC WIRING CONTRACTING
ELECTRICAL CONTRACTING
ELECTRICAL ENGINEERING ON CONSTRUCTION PROJECT
ELECTRICAL REPAIR WORK ON BUILDING
ELECTRICAL WORK ON CONSTRUCTION PROJECT
ELEVATOR INSTALLATION
ESCALATOR INSTALLATION
EXCAVATING, EXCEPT OIL WELL SLUSH PIT AND CELLARS
EXCAVATING OIL WELL SLUSH PIT AND CELLARS, CONTRACT SERVICES
FACTORY CONSTRUCTION
FIRE ESCAPE INSTALLATION
FOUNDATION BUILDING
FOUNDATION BUILDING AT OIL WELL LOCATION, CONTRACT SERVICES
FRESCO WORK ON CONSTRUCTION PROJECT
FUEL OIL BURNER INSTALLATION
FUEL OIL BURNER MAINTENANCE
FURNACE INSTALLATION
GAS ENGINEERING AND FITTING ON CONSTRUCTION PROJECT
GAS MAIN CONSTRUCTION
GAS WORKS CONSTRUCTION
GENERATING STATION CONSTRUCTION
GLASS INSTALLATION ON CONSTRUCTION PROJECT
GLAZIER, OWN ACCOUNT
GLAZING REPAIR WORK
GOLF COURSE CONSTRUCTION
GRADING AND BUILDING FOUNDATIONS AT OIL WELL LOCATIONS, CONTRACT SERVICES
GUARD RAIL CONSTRUCTION
GUNITE WORK ON CONSTRUCTION PROJECT
HARBOUR CONSTRUCTION
HARDWOOD FLOORING INSTALLATION
HARDWOOD FLOORING REPAIR
HEATING SYSTEM INSTALLATION
HEATING SYSTEM REPAIRING
HIGHWAY CONSTRUCTION
HIGHWAY DEMOLITION
HIGHWAY MAINTENANCE AND REPAIR
HIGHWAY SIGN INSTALLATION
HOME CONSTRUCTION
HOSPITAL CONSTRUCTION
HOTEL CONSTRUCTION
HOUSE BUILDING
HOUSE DEMOLISHING
HOUSE EXTERIOR DECORATING
HOUSE MOVING
HOUSE PAINTING
HOUSE PAINTING REPAIR WORK
HOUSE WRECKING
HYDROELECTRIC PLANT CONSTRUCTION
INCINERATOR CONSTRUCTION
INDUSTRIAL BUILDING CONSTRUCTION
INSULATION REPAIR WORK ON BUILDINGS
INSULATION WORK ON CONSTRUCTION PROJECTS
IRON ORE MINE DIAMOND DRILLING, CONTRACT SERVICES
IRON ORE MINE SHAFT SINKING, CONTRACT SERVICES
IRRIGATION PROJECT CONSTRUCTION
LAND RECLAMATION, CONSTRUCTION
LANDING FIELD CONSTRUCTION
LEVEE CONSTRUCTION
LIGHTHOUSE CONSTRUCTION
LIGHTING SYSTEM INSTALLATION
LIGHTING SYSTEM REPAIRING
LOCK, WATERWAY, CONSTRUCTION
MAINTENANCE INVOLVING CONSTRUCTION WORK
MARBLE WORK, INTERIOR, CONSTRUCTION
MARBLE WORK, INTERIOR, FINISHING
MASONRY REPAIR WORK
MASONRY WORK ON CONSTRUCTION PROJECT
METAL MINING, OVERBURDEN REMOVAL, CONTRACT SERVICES
MILITARY BARRACK CONSTRUCTION
MINE DISCHARGING STATION CONSTRUCTION
MINE LOADING STATION CONSTRUCTION
MISSILE FACILITIES CONSTRUCTION
MISSILE LAUNCHING PAD AND TOWER CONSTRUCTION
MOSAIC WORK ON CONSTRUCTION PROJECT
NAVIGATION CHANNEL CONSTRUCTION
NON-FERROUS METAL MINE DIAMOND DRILLING, CONTRACT SERVICES
NON-FERROUS METAL MINE SHAFT SINKING, CONTRACT SERVICES

OIL FIELD DIAMOND DRILLING, CONTRACT SERVICES
OIL PIPELINE CONSTRUCTION
OIL PUMPING STATION CONSTRUCTION
OIL REFINERY CONSTRUCTION
OIL WELL ACIDIZING, CONTRACT SERVICES
OVERBURDEN REMOVAL, COAL MINES, CONTRACT SERVICES
OVERBURDEN REMOVAL, IRON ORE MINES, CONTRACT SERVICES
OVERBURDEN REMOVAL, NON-FERROUS METAL MINES, CONTRACT SERVICES
OVERBURDEN STRIPPING, MINES, CONTRACT SERVICES
PAPERHANGING
PARKING AREA CONSTRUCTION
PARKWAY CONSTRUCTION
PARQUET FLOORING CONTRACTOR
PAVING CONTRACTING
PAVING REPAIR WORK
PERFORATING OIL WELLS, CONTRACT SERVICES
PETROLEUM AND GAS WELL SINKING AND DRILLING, CONTRACT SERVICES
PIER, MARINE, CONSTRUCTION
PILE DRIVING
PIPELINE CONSTRUCTION
PLASTER REPAIR WORK
PLASTERING ON CONSTRUCTION PROJECT
PLUMBING ON CONSTRUCTION PROJECT
PLUMBING REPAIR WORK
POWER DISTRIBUTION STATION CONSTRUCTION
POWER PLANT CONSTRUCTION
PREFABRICATED BUILDING ERECTION
PUBLIC SEWER CONSTRUCTION
PULLING CASINGS, TUBES AND RODS, GAS AND OIL WELLS, CONTRACT SERVICES
PUMPING STATION CONSTRUCTION
RADIO STATION CONSTRUCTION
RADIO TOWER CONSTRUCTION
RAILWAY LINE, ELECTRIC, CONSTRUCTION
RAILWAY LINE, STEAM, CONSTRUCTION
RAILWAY ROADBED CONSTRUCTION
RAILWAY STATION CONSTRUCTION
REFRIGERATION SYSTEM INSTALLATION
REPAIR INVOLVING CONSTRUCTION WORK
RESERVOIR, MUNICIPAL, CONSTRUCTION
RESIDENTIAL BUILDING CONSTRUCTION
REVOLVING DOOR INSTALLATION
ROAD CONSTRUCTION
ROAD TARRING
ROCK REMOVAL ON CONSTRUCTION PROJECT
ROOF REPAIRING
ROOFING WORK ON CONSTRUCTION PROJECT
SALT MINE DEVELOPING, CONTRACT SERVICES
SANATORIUM CONSTRUCTION
SAND BLASTING
SANITATION SYSTEM CONSTRUCTION
SEPTIC TANK INSTALLATION
SEWAGE DISPOSAL PLANT CONSTRUCTION
SEWER CONSTRUCTION
SHAFT SINKING, NON-METALLIC MINERAL MINES, CONTRACT SERVICES
SHEET METAL REPAIR WORK ON BUILDING
SHEET METAL WORK ON CONSTRUCTION PROJECT
SIDEWALK CONSTRUCTION
SILO CONSTRUCTION
SINKING OIL WELL, CONTRACT SERVICES
SLATING AND TILING
SPRINKLER SYSTEM INSTALLATION
STEAM CLEANING BUILDING EXTERIOR
STEAM RAILWAY ROADBED CONSTRUCTION
STONE WORK ON CONSTRUCTION PROJECT
STONE WORK REPAIRING
STREET CONSTRUCTION
STREET DEMOLITION
STRIP MINING, CONTRACT SERVICES
STUCCO WORK ON CONSTRUCTION PROJECT
SUBWAY CONSTRUCTION
SULPHUR MINE DEVELOPING, CONTRACT SERVICES
SWABBING OIL WELLS, CONTRACT SERVICES
SWIMMING POOL CONSTRUCTION
SWITCHING STATION CONSTRUCTION
TELEGRAPH LINE CONSTRUCTION
TELEPHONE LINE CONSTRUCTION
TELEVISION TOWER CONSTRUCTION
TENNIS COURT CONSTRUCTION
TERRAZZO WORK ON CONSTRUCTION
TILE LAYING
TILE SETTING
TINSMITHING ON CONSTRUCTION PROJECT
TRAFFIC LANE PAINTING, CONTRACTOR
TRANSFORMER STATION CONSTRUCTION
TRANSMISSION LINE CONSTRUCTION
TRENCHING ON CONSTRUCTION PROJECT
TUNNEL CONSTRUCTION
VENTILATING SYSTEM INSTALLATION
VENTILATING SYSTEM REPAIRING
VIADUCT CONSTRUCTION
WALLPAPERING
WATER MAIN CONSTRUCTION
WATER PROJECT CONSTRUCTION
WATER PUMPING STATION CONSTRUCTION
WATER SUPPLY PIPELINE CONSTRUCTION
WATER WELL DRILLING
WATER WORKS CONSTRUCTION
WATERPROOFING BUILDING
WATERWAY CONSTRUCTION
WHARF CONSTRUCTION
WINDOW SASH INSTALLATION
WIRING INSTALLATION ON CONSTRUCTION PROJECT
WIRING REPAIR WORK ON BUILDING
WOOD FLOORING INSTALLATION

(ii) International Recommendations for Construction Statistics, United Nations Statistical Papers Series M, No. 47, New York, 1968, on the basis of which countries prepare their national statistics to be incorporated in the UN Yearbook of Construction Statistics. Its structure is as follows:

I. [illegible]

1. Number of statistical units
2. Number of persons engaged
3. Number of employees
4. Wages and salaries of employees
5. Value of total output
6. Value of construction put in place
   (a) New construction and capital repairs
      (i) Buildings
         a. Residential
         b. Non-residential
      (ii) Civil engineering
   (b) Current repairs and maintenance
7. Value added

II. FIXED ASSETS

1. Gross additions to fixed assets
   (a) Machinery, transport and other equipment
   (b) Buildings etc.
2. Cost of new fixed assets acquired
   (a) Machinery, transport and other equipment
   (b) Buildings etc.

III. [illegible]

All buildings	Number
	Floor area
	Tender value
1. Residential buildings	Number
	Floor area
	Tender value
(a) One- or two-dwelling buildings	Number
(b) Multi-dwelling buildings	Number
2. Non-residential buildings	Number
	Floor area
	Tender value
(a) Industrial buildings	Number
	Floor area
	Tender value
(b) Commercial buildings	Number
	Floor area
	Tender value
(c) Educational buildings	Number
	Floor area
	Tender value
(d) Health buildings	Number
	Floor area
	Tender value
(e) Other buildings	Number
	Floor area
	Tender value

IV. [illegible]

1. All dwellings	Number
	Floor area
	Tender value
(a) New construction in residential buildings	Number
	Floor area
(i) In one- or two-dwelling buildings	Number
(ii) In multi-dwelling buildings	Number
(b) New construction in non-residential buildings	Number
	Floor area
(c) Created by restoration and conversion	Number
	Floor area
2. All dwellings, by type of location:	
(a) Public	Number
(i) State and local governments	Number
(ii) Other public bodies	Number
(b) Private	Number
(i) Co-operatives	Number
3. All dwellings by location:	
(a) In urban areas	Number
(b) In rural areas	Number
4. Rooms in all dwellings	Number

V. [redacted]

All buildings	Number
	Floor area
	Value
1. Residential buildings	Number
	Floor area
	Value
(a) One- or two-dwelling buildings	Number
(b) Multi-dwelling buildings	Number
2. Non-residential buildings	Number
	Floor area
	Value
(a) Industrial buildings	Number
	Floor area
	Value
(b) Commercial buildings	Number
	Floor area
	Value
(c) Educational buildings	Number
	Floor area
	Value
(d) Health buildings	Number
	Floor area
	Value
(e) Other buildings	Number
	Floor area
	Value

VI. [redacted]

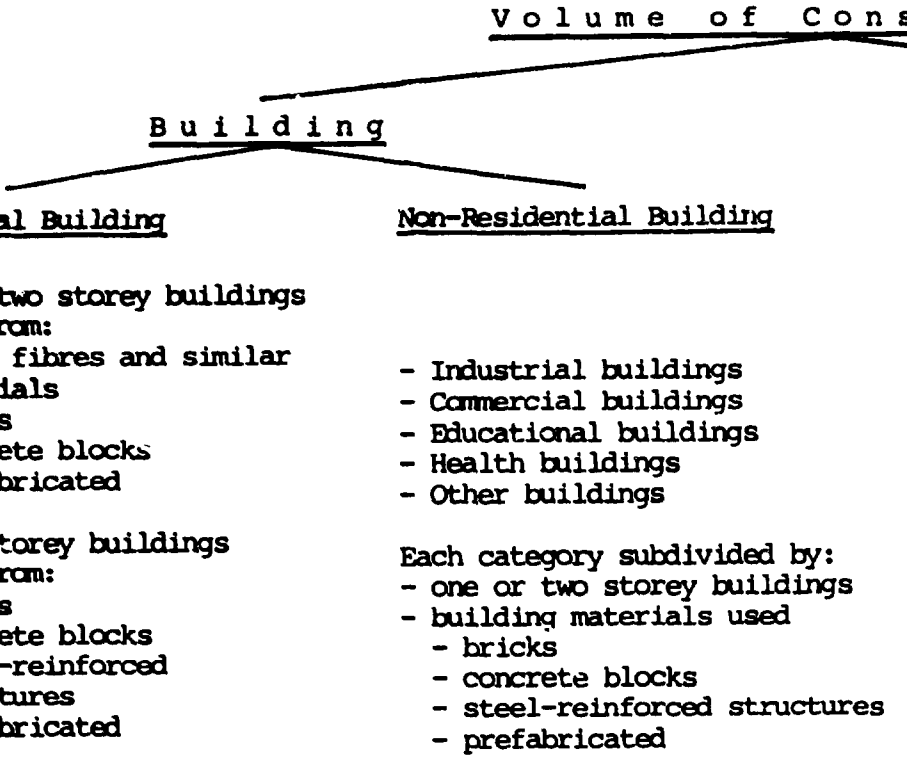
1. All dwellings	Number
	Floor area
	Value
(a) New construction in residential buildings	Number
	Floor area
(i) In one- or two-dwelling buildings	Number
(ii) In multi-dwelling buildings	Number
(b) New construction in non-residential buildings	Number
	Floor area
(c) Created by restoration and conversion	Number
	Floor area
2. All dwellings, by type of investor:	
(a) Public	Number
(i) State and local governments	Number
(ii) Other public bodies	Number
(b) Private	Number
(i) Co-operatives	Number
3. All dwellings by location:	
(a) In urban areas	Number
(b) In rural areas	Number
4. Rooms in all dwellings	Number

These two classifications can hardly be used in their actual form for disaggregated forecasting for the following reasons: (i) The ISIC-Classification combines all construction types together in one group and simply lists them in alphabetic order. (ii) In addition, the number of items seems to be too large for individual forecasting. Their regrouping in systematic subdivisions is required. (iii) On the other hand, the "Recommendations" do not foresee any subdivision of the large subsector of civil engineering at all. (iv) Neither of the two classifications makes any explicit provision with respect to construction work standards which may have an important bearing on the type of materials to be used.

Therefore, more appropriate subdivisions have to be searched for. Of what is "appropriate" depends on prevailing conditions in individual countries such as the features of the existing statistical system and cost implications of such effort and should be decided at that level. It would be convenient, however, to keep consistency with the above two international classifications. In graph 9 a model has been sketched which may serve as a guideline for disaggregating construction with the purpose to carry out demand forecasts for building materials. In many countries, in a first instance, such a model might be difficult to pursue because conventional statistical classifications seldom use different types of building materials as criteria to define construction categories. Those countries will need efforts to adapt their construction statistics to the requirements for forecasting the building materials demand more systematically.

Following the disaggregation of total construction, forecasts can be carried out for at least the major categories, by using regression analysis or as far as available overall socio-eco-

Graph 9: Volume of Construction by Different Categories



s t r u c t i o n

Civil Engineering

Road Construction

- Paved roads by major pavement standards
- Gravel roads by type of gravel
- Earth roads
- Bridges

Other Civil Engineering

- other transport works (railway tracks, bridges, tunnels, stations, etc.)
- Water supply and sewage works, dams, canals, ports, coast protection etc.
- Energy production and supply (oil and electricity) and telecommunication works

nomic and input-output models.[1] With respect to regression analysis for each category the most appropriate independent variable has to be identified. For sectoral building categories, for instance, the respective sector's contribution to GDP or GFCF may very likely be a more significant reference than their total values. Such forecasting can be done in terms of both quantities and values at constant prices. Furthermore, sector programmes, pre-investment- and feasibility studies may constitute a valuable information source to refine the forecasts at this level of disaggregation, in particular, in those fields where longer-term programming is applied and projects have a long maturity schedule such as infrastructure works.

The building subsector particularly materials intensive can even be further subdivided into various element such as foundation, floor, walling, doors and windows, roof and ceiling work, painting and gearing, electrical installation, sanitary and plumbing fittings and others.

In a next step, major building materials have to be identified. Though the determination of what is "major" will depend upon specific conditions in individual countries there are common features prevailing at least in "modern" construction all over the world and which often are prescribed by technical standards. The following list may provide a guideline for subdividing the building materials into categories.

Finally, the building materials have to be linked to the forecasts of individual construction types. There is a large amount of research work which has been carried out all over the world on the consumption of different building materials by different types of construction work. Furthermore, both national and international standards and specifications prescribe the utiliza-

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1) CMT (1982), op.cit., Appendix 1.

Classification of Building Materials

(from T.P. O'Brien, D.A. Turin, op.cit., p. 89)

1. Building stone (Sedimentary)
2. Building stone (Igneous and Metamorphic)
3. Natural aggregates
4. Synthetic aggregates

5. Portland cements
6. Limes
7. Gypsum plasters
8. Plasterboard
9. Glass sheet

10. Concrete blocks
11. Concrete tiles
12. Concrete pipes
13. Sand-lime bricks
14. Asbestos-cement products
15. Precast concrete units
16. Prestressed concrete units
17. Woodwool slabs

18. Clay bricks / blocks
19. Clay tiles
20. Ceramic and stoneware pipes
21. Ceramic sanitary ware

22. Sawnwood
23. Plywood panels
24. Chipboard units
25. Timber window frames
26. Timber flush doors

27. Plastics panels
28. Other plastics products
29. Roofing felts
30. Paints and varnishes
31. Joint sealants and mastics

32. Reinforcing bars
33. Rolled steel sections
34. Structural steel products
35. Steel pipes
36. Cast-iron pipes
37. Steel window frames
38. Stainless steel sheet

39. Aluminium sheet / extrusions
40. Aluminium window frames
41. Copper / brass pipes

tion of specific materials including their technical qualities for specific construction types. Though referring to data from a developed country a rather comprehensive pattern is outlined in table 5 which may provide some guidelines for similar ventures in developing countries. Such efforts have to be undertaken on country or even regional and local levels because the weights of individual materials depend on various national and local conditions such as climate, location (urban, rural), level of income etc. and may vary as well over time as a result of changing technologies and attitudes.

This step by step approach may require considerable efforts in some countries. Moreover, the same degree of disaggregation may not be required for newly industrializing and least developed, large and small countries; each country would need to adapt the approach to its own conditions. Its main advantage, however, is that it leads to forecasts of the building materials demand which are detailed enough to qualify for an adequate and operational tool to program the supply side and to guide the respective entrepreneurial decision-making.

Table 5: Materials Usage in New Buildings

	Unit	Houses & Bungalows		Low Flats (3 storeys)		High Flats (12 storeys)		Factories (1 storey)		Schools (1-2 storeys)		Offices (3 storeys)	
		(1)[a]	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
ROOF													
(a) Cover & Finish													
Asphalt	m^2	70.5	•	34.5	8	8.5	55	100	17	66.5	45	40	38
Roofing felt	m^2	70.5	•	34.5	7	8.5	44	95	28	66.5	30	40	56
Aluminium	m^2	70.5	•	36	5	8.5	•	95	•	66.5	•	40	•
Asbestos Cement	m^2	86	•	36	•	-	-	95	52	66.5	•	40	5
Concrete tiles	m^2	86	78	39.5	60	-	-	-	-	79	20	47.5	•
Clay tiles	m^2	86	13	39.5	9	-	-	-	-	79	•	47.5	•
(b) Cover Support													
Sawnwood	m^3	0.25	96	0.12	75	-	-	3.5	18	2.7	25	1.1	40
Asbestos Cement	m^2	-	-	-	-	-	-	95	52	66.5	5	40	10
Metal decking	m^2	-	-	-	-	-	-	95	•	66.5	5	40	10
Strawboard	m^2	82.5	•	36	8	-	-	95	5	66.5	20	40	10
Concrete	m^3	9.5	•	4.3	15	(b)	100	12	22	6.7	45	4.3	25
(c) Structure													
Sawnwood	m^3	2.1	100	0.9	90	-	-	(c)	•	3.5	25	0.45	40
Steel	t_3	-	-	-	-	-	-	1.1	82	1.1	60	1.1	45
Concrete	m^3	-	-	(d)	10	(b)	100	(d)	16	5.8	15	4.3	15
(d) Insulation													
25mm Glasswool & Slagwool	m^2	60	70	34.5	65	-	-	95	45	66.5	45	40	67
12mm Fibreboard	m^2	60	•	34.5	•	-	-	95	40	66.5	5	40	5
Light. Screed	m^3	5.3	•	1.7	15	0.3	100	9.6	8	7	47	3.5	7.5
Woodwool Slabs	m^2	60	•	-	-	-	-	95	8	-	-	40	7.5

Note: (a) Column (1) - Estimated measure per 100 m^2 of gross floor area

Column (2) - Estimated percentage use in 1964

Table 5: Materials Usage in New Buildings (contd.)

	Unit	Houses & Bungalows		Low Flats (3 storeys)		High Flats (12 storeys)		Factories (1 storey)		Schools (1-2 storeys)		Offices (3 storeys)	
		(1)[a]	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
(e) Lining													
Plasterboard	m^2	60	98	32	98	8.5	20	95	40	66.5	35	35	75
Fibreboard	m^2	60	•	32	•	8.5	•	95	40	66.5	10	35	10
Plastering	m^2	60	90	32	90	8.5	75	-	-	66.5	45	35	45
Timber Boarding	m^2	60	•	-	-	-	-	-	-	-	-	35	•
Acoustic Tiles	m^2	-	-	-	-	-	-	95	•	66.5	•	35	5
(f) Roof Drainage													
Gutters:													
Cast Iron	m	16.4	24	8.2	35	-	-	(c)	(c)	15	60	6.5	45
Asbestos	m	16.4	27	8.2	38	-	-	(c)	(c)	15	30	6.5	30
Plastics	m	16.4	47	8.2	23	-	-	(c)	(c)	15	5	6.5	10
Aluminium	m	16.4	•	8.2	•	-	-	(c)	(c)	15	5	6.5	10
Pipes:													
Cast Iron	m	6.5	24	2	35	0.7	92	(c)	(c)	8	60	4	45
Asbestos	m	6.5	27	2	38	0.7	8	(c)	(c)	8	30	4	30
Plastics	m	6.5	47	2	23	-	-	(c)	(c)	8	5	4	10
Aluminium	m	6.5	•	2	•	-	-	(c)	(c)	8	5	4	10
MAIN STRUCTURE													
Timber	m^3	(c)	•	(c)	•	-	-	-	-	1.1	•	(c)	•
Steel	t_3	(c)	•	(c)	•	(c)	•	1.4	80	1.4	42	(c)	25
Concrete	m^3	(e)	10	(e)	10	25	99	7	15	1.1	30	6.6	25
Brickwork	m^3	(e)	88	(e)	88	(e)		(e)	5	(e)	26	(e)	50

Table 5: Materials Usage in New Buildings (contd.)

	Unit	Houses & Bungalows		Low Flats (3 storeys)		High Flats (12 storeys)	
		(1)[a]	(2)	(1)	(2)	(1)	(2)
WALLS							
(a) External							
Brickwork	m^3	27	85	40	49	37	47
Light. Conc.Block	m^3	27	1'	40	49	37	47
Timber Boarding	m^2	93.5	•	25.5	•	23	•
Asbestos	m^2		-	25.5	•	23	•
Prop.curtain wall	m^3	-	-	-	-	23	•
Concrete	m^2	27	•	40	•	37	5
Infill panels	m^2	-	-	-	.	-	-
Stone cladding	m^2	-	-	-	-	-	-
(b) Windows							
Aluminium	m^2	12	•	18	•	18	25
Galv. steel	m^2	12	30	18	45	18	35
Wood	m^2	12	69	18	50	18	40
Plastics coated	m^2	-	-	-	-	-	-
(c) External Doors							
Wood	m^2	4.5	100	4	97	4	97
Metal	m^2	-	-	4	•	4	•
(d) Internal Doors							
Wood	m^2	10(No)	100	13	100	12	100
Metal	m^2	-	-	-	-	-	-

Factories (1 storey)		Schools (1-2 storeys)		Offices (3 storeys)	
(1)	(2)	(1)	(2)	(1)	(2)
10.5	)58	15	49	24	35
10.5	)	15	•	24	•
-	-	80	10	72	5
36	33	40	•	36	•
36	•	40	5	36	10
4.5	•	3	20	9.5	20
36	5	40	15	36	10
-	-	-	-	36	15
9	19	30	15	16	15
9	79	30	20	16	79
9	•	30	64	16	5
-	-	30	•	16	•
(c)	65	2.5	65	(c)	99
(c)	35	2.5	35	(c)	•
(c)	65	18	99	5(No)	95
(c)	30	18	•	5(No)	5

Table 5: Materials Usage in New Buildings (contd.)

	Unit	Houses & Bungalows		Low Flats (3 storeys)		High Flats (12 storeys)		Factories (1 storey)		Schools (1-2 storeys)		Offices (3 storeys)	
		(1)[a]	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
(e) Wall Finish (internal surface)													
Plaster	m^2	93.5	90	127	90	120	80	36	5	40	55	72	50
Plasterboard	m^2	93.5	10	127	10	120	10	36	5	40	30	72	20
Integral	m^2	-	-	-	-	(b)	10	(b)	90	40	10	(b)	30
Asbestos	m^2	-	-	-	-	-	-	-	-	40	5	-	-
(f) Partitions & Int. Walls													
Brickwork	m^3	15.4	23	14.5	55	-	-	(c)	(c)	5	35	16.5	20
Lght.Conc.Blocks	m^3	15.4	70	8.8	45	8.2	48	(c)	(c)	5	50	16.5	45
Prefabricated Units	m^2	82.5	•	106	5	101	•	(c)	(c)	35	10	85	30
Concrete	m^2	-	-	-	-	(b)	50	(c)	(c)	-	-	9.2	•
Timber stud	m^2	3.5	•	-	-	-	-	(c)	(c)	35	5	85	•
(g) Partition Finish													
Plaster	m^2	165	88	127	88	120	50	(c)	(c)	70	80	85	50
Plasterboard	m^2	165	10	127	10	120	10	(c)	(c)	70	10	85	10
Integral	m^2	165	•	127	•	120	40	(c)	(c)	70	10	85	30
Asbestos	m^2	-	-	-	-	-	-	(c)	(c)	-	-	85	10
FLOORS													
(a) Structure													
Wood	m^3	1.7	55	1.5	•	-	-	-	-	3.4	20	0.5	5
Concrete	m^3	6	45	12	98	(b)	100	15	99	15	79	15	95

Table 5: Materials Usage in New Buildings (contd.)

	Unit	Houses & Bungalows		Low Flats (3 storeys)		High Flats (12 storeys)		Factories (1 storey)		Schools (1-2 storeys)		Offices (3 storeys)	
		(1)[a]	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
(b Surface													
Wood	m^2	92.5	60	98	5	98.5	5	100	5	98.5	15	95.5	55
Concrete	m^2	-	-	-	-	-	-	(b)	60	-	-	20	5
Granolithic	m^2	-	-	92.5	5	93.5	5	100	30	98.5	•	95.5	•
Thermoplastic	m^2	92.5	35	92.5	75	93.5	74	100	)	98.5	5	95.5	10
Linoleum	m^2	92.5	•	92.5	•	93.5	5	100	)5	98.5	25	95.5	•
Rubber	m^2	92.5	•	92.5	)14	93.5	)10	100	)	98.5	10	95.5	5
PVC	m^2	92.5	•	92.5	)	93.5	)	100	)	98.5	20	95.5	5
(c) Soffits (Ceilings)													
Plastics	m^2	-	-	-	-	-	-	(c)	(c)	-	-	70	•
Fibreboard	m^2	-	-	-	-	-	-	(c)	(c)	-	-	70	10
Plaster	m^2	60	90	63.5	90	90	60	(c)	(c)	33.5	60	70	50
Acoustic Tiles	m^2	-	-	-	-	-	-	(c)	(c)	33.5	5	70	5
Plasterboard	m^2	60	98	63.5	98	-	-	(c)	(c)	33.5	30	70	75
Integral	-	-	-	-	-	(b)	40	(c)	(c)	-	-	-	-
(d) Stairs													
Wood	m^3	0.3	67	0.3	10	-	-	(c)	(c)	0.1	5	0.1	10
Metal	m^3	-	-	-	-	-	-	(c)	(c)	(c)	35	(c)	5
Concrete	m^3	-	-	0.1	100	(b)	100	(c)	(c)	0.1	60	0.1	85

For notes and source see following page.

(a) Col. (1) Estimated measure per 100 sq.m. of gross floor area
Col. (2) Estimated percentage use in 1964.
(b) Included under main structure.
(c) No basis for estimating.
(d) Included under cover support.
(e) Included under walls and/or floors.

Source: 'Materials Usage in New Buildings', B.D. Cullen, Building, Vol. 212, Jan. 27, London 1967, quoted from T.P. O'Brien, D.A. Turin, op.cit., pp. 71-76.

A glance at table 5 shows that it refers to a developed country. The proportion of different materials used obviously corresponds to a specific set of conditions. It should be noted that the percentages usually sum to 100 %, with those marked with an asterisk representing less than 5 %. A sum less than 100 % indicates that a particular function is not always performed in the building type in question, or that the usage of some materials is too small to justify a separate estimate. A sum greater than 100 % indicates that two or more materials are used in conjunction to perform the function.

VII. Forecasting of Construction and Building Materials Supply

From an ex-post view, demand always equals supply. This refers, however, exclusively to effective demand and does not say anything (i) about the degree of fulfilment of construction and building materials needs in the past and (ii) about gaps between planned targets and achievements i.e. the realisation rate of planned demand. Such gaps may result from respective decreases in finance (decline in monetary terms) or from price increases due to insufficient supply or other constraints which have led to less construction work within the same investment allocations (decline in real terms, only). Furthermore, this general view does not allow to identify the extent to which this demand has been met by domestic resources or had to take recourse to foreign supplies and whether the latter's share has been growing. These are key issues in many developing countries.

A first approach would consist of forecasting the supply side on the basis of past trends. Keeping in mind the above considerations no concern would be raised within this procedure as to the adjustment problem in the past and its continuing impact on the future performance of the sector. For it is simply assumed that previous trends such as for prices and recourse to foreign supplies will continue. In case, however, accelerating demand is anticipated an (additional) adjustment gap would arise which could be specified further according to the level of disaggregation established for demand forecasting of different types of construction works and building materials. On the other hand, in the case of declining demand expectations less imports or/and an underutilization of existing capacities would be the outcome which could be specified

accordingly. Supply forecasts refering to previous growth tend to neglect the already prevailing and accumulated adjustment pressures by taking into account only furthcoming effects.

If, as it is suggested by "western" economic theory and more or less postulated by policy makers in western industrialized countries, the supply side should adapt automatically to demand no government intervention to promote supplies will be necessary. Under this hypothesis excessive demand evolution - except for short term frictions - would imply neither increasing imports of supplies nor rising prices; other factors remaining constant such as general price level and international competitiveness.

Due to various reasons,[1] in developing countries adjustment processes do not perform automatically. An approach, therefore, which extrapolates past supply evolution and then identifies simply (additional) forthcoming supply constraints only would hardly satisfy. In the light of the many interconnected constraints a more comprehensive approach is desirable which specifies and takes into account the already prevailing bottlenecks in a systematic way. Indicators to quantify supply constraints could be for instance the share of imported contractor services and building materials and its evolution as well as relative price increases (domestic price indexes for construction works and materials related to respective import price indexes or/and to the general domestic price index). They may constitute among others early warning signs for government measures.

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1) For further details see F.Moavenzadeh, F.Hagopian, op.cit., pp. 280-290; J.Riedel, Planning Development Processes in the Third World: The Construction Sector, in: TIMS Studies in the Management Sciences 17 (1981), pp.161-197.

VIII. Promoting the Construction and Building Materials Sector

Due to the technical and economic underdevelopment of the construction and building materials sector in most developing countries supply forecasts may rather take the form and imply the necessity to establish a systematic promotion policy which should not only cover the domestic construction and building materials sector itself but also extend to other related issues and sectors such as technology policies, technical standards and specifications, financing in terms of both domestic and foreign for investment (equipment) as well as working capital, export and import policies, skills, the role of engineering and economic design consultancy, building materials, trade etc. Referring to inventories of domestic resources and their potential development (graph 3) as well as to estimations of future supplies within national development plan preparation (graph 4) comprehensive and in depth surveys need to be prepared as a basis for systematic policy formulation and implementation.

Major issues have to be determined on national levels because resource availability and types and weights of shortcomings are varying from country to country. Problems and their degree of incidence are different between larger and smaller countries and between newly industrializing countries which already dispose of relatively well developed construction and building materials industries and many of which, moreover, are active in exports, and less developed countries hardly possessing any nucleus of a domestic activity in this field, apart from the traditional and informal sector. Independently from the preponderance of issues in individual countries for such a systematic policy aiming at the promotion of domestic

resources and production a common pattern can be formulated which takes into account and interlaces a broad spectrum of different issues. Since construction and building materials are very closely connected there is good reason for policy makers to conceive their respective policy accordingly. In line with this consideration, the following listing of issues therefore, refers to both sub-sectors and includes as well demand and institutional aspects because of their considerable impact on the domestic supply performance.

Model Conception for Promoting the Construction and Building Materials Industries

Checklist of Major Issues

I. General Rationale for Issues

1. Promotion of the awareness and willingness of Governments to realize construction and building materials as being a comprehensive economic sector with significant linkages to other sectors and moreover a key sector in development efforts, thus an important area of public policy.

2. Increase of the perception that the development of this sector implies interdisciplinary aspects and requires a multisectoral and multitarget approach.

3. Adaptation of product technology (specifications of work targets) to domestic resources and process technology (capability of domestic construction and building materials industries) i.e. set-up of an integrated demand/supply development conception for this sector.

4. Strengthening the planning, management and organization performance with respect to domestic construction and building materials, in particular contractors, department forces, manufacturing and financing.

5. Taking into consideration the interactions among the parties involved in the construction process and their functional interests such as the user (consumer)

and the customer or client (investor) of the built structure, the planner, architect, construction and design engineer, the construction enterprise (contractor), the producer and trader of building materials and the banker.

II. Individual Issues

1. Institutional

(a) Establishment, if not yet in existence, of an Unit in Government, to be concerned with the development of the construction and building materials industries.

(b) Establishment of a steering committee on construction and building materials with the participation of ministries, parastatal agencies, development banks as well as representatives of the engineering consultancy, private contractors and of the building materials industry (connection to private sector). The purpose of this committee is to identify the sector's problems and to find solutions for alleviating them, to strengthen co-operation between the public and private sectors and to coordinate the programs of the parties involved in construction (coordination of planning from the bottom and planning from the top).

(c) Establishment of or reactivating national constractors' association to constitute a clearing house for a dialogue on pertinent issues, to provide relevant information and advice to its members and to collect their views and represent them to govern-

ment policy makers. This association should cooperate closely with the building materials industry group (Chamber of Commerce and Industry) the national architects and engineers association and the banking sector (Planning from the bottom).

2. Demand Side

In view of the expensive and therefore scarce foreign resources a systematic government policy with respect to the promotion of construction demand has to be based primarily on the availability and the development potential of domestic resources. Hence, in the developing countries, generally with high foreign debts, it is not the question to increase the volume of works in general but to give priority to those structures which can be produced with a maximum of domestic materials and skills without ignoring basic standards of safety, health, sanitation, social organization and welfare. In other words, all factors and preconditions which bias against this principle should be carefully reviewed. In line with an interdisciplinary approach and with multisectoral targets, actions should be considered on construction and land use legislation, the planning machinery and on political measures to promote construction demand among which political (shadow) pricing may play a certain role.

(a) Measures with respect to legislation

Regarding the improvement and adaptation of prevailing legislation it might be considered:

(i) to simplify, adjust and redraft construction laws and regulations as well as the procedures for handling construction permits without hurting universal sanitary and safety conditions;

(ii) to develop standards of design and implementation of works, which are technically suited to local conditions, resources such as available building materials and skills and whose cost is reasonable (value engineering);

(iii) to review the existing system of technical standards and specifications with respect to both construction and building materials and to adjust it wherever possible to national and local conditions as well as to reorganize or/and strengthen the national standard institute and testing laboratory system;

(iv) to improve the land registry system and to settle land ownership particularly in urban areas;

(v) to formulate a code which aims to clarify the duties, responsibilities and rights of the different parties involved in the construction process such as clients, contractors, etc., and to establish an institution for the prompt and fair settlement of disputes.

(b) Measures with respect to planning

(i) to amend data collection and use and to adapt the statistics organization to planning requirements, for example, to prepare information inventories on existing structures in terms of volume and conditions at local and regional level;

(ii) to explicitly tie construction programmes to national development plans, to share out public

construction expenditure among individual types of work, to regionalize and schedule construction programmes and link them with building materials and other sector programmes;

(iii) to decentralize construction planning and control and to integrate citizen participation to make construction fit in better with local conditions in particular materials locally available and stimulate the users' interest;

(iv) to develop technology-political instruments aiming at simple technical solutions which basically fulfill - but are not in excess of - the users' needs and are more adequate to the availability of resources;

(v) to strengthen town planning and above all its implementation by focussing on the needs of the informal residential sector and its localization as it relates to the people's access to services and employment;

(vi) to place emphasis on the upgrading for squatters' spontaneous settlements via the granting of land ownership and allocation of infrastructure which fulfills minimum needs as well as on the provision of developed sites with access to the public water supply, sewerage, electricity, road network and communal services;

(vii) to subsidize selected building materials appropriate for self-help construction in urban areas.

(c) Measures with respect to construction demand

These measures address both the public sector and the private sector. It might be considered:

(i) to stabilize public demand for construction through continuous planning and scheduling of works, to consider benefits of extending works' implementation over longer periods in order to guarantee permanent jobs for domestic construction and building materials industries and as well those benefits which may be realized by concentrating the demand on works which can be taken over by small and medium domestic contractors and materials suppliers;

(ii) in this context to concentrate on construction works which demand relatively small public funds but may stimulate agricultural production and reduce rural exodus such as rural feeder roads, waterways, storage buildings and other smaller infrastructure works;

(iii) to mobilize capital savings by providing better safeguards against inflation, to make available cheaper loans and credit guarantees in order to support private housing, and to develop mortgage financing;

(iv) to encourage the opening of supply centers for building materials and tools in connection with advisory, training and financing schemes in order to support self-help housing for lower income groups in particular in areas where site and service projects are initiated and in smaller urban centers and rural areas;

(v) to place higher emphasis on current maintenance and repairs and rehabilitation of existing structures by means of direct measures, education and training as well as financial subsidies;

(vi) to develop interstate cooperation if national markets prove to be too limited for larger domestic

contractors, engineering firms as well as the production of building materials and technical equipment.

3. Measures with respect to the Supply Side

Policies to strengthen the supply side, i.e. to promote the utilization of domestic resources in terms of availability and factor price proportion should also pursue a multisector and multitarget approach. The larger and better utilization of locally available building materials, the development of appropriate project design (product technology) and the support of labor-intensive methods (process technology) should be considered wherever it is possible and feasible in order to reduce dependency on increasingly expensive materials and equipment and to save on the scarce capital factor. This applies to both financing capital in foreign and in national currency. Such a strategy implies as a first priority target the development of a construction technology policy to be based (i) on existing building materials and capability and efficiency of domestic construction and building materials industry and (ii) on their development potential. Furthermore, action might be undertaken to get domestic contractors more involved in public construction even at the expense of intensive assistance to be required. More specifically, it might be considered with respect to:

(a) Domestic and private contractors and departmental forces

(i) to strengthen the entrepreneurial capabilities in terms of organization and management whether trough

contractors' asociations or public assistance programs, whether by training courses and seminars or assistance on-the-job;

(ii) to introduce preferential clauses in bidding public contracts and to give particular preference to private contractors in construction maintenance and works in rural areas and in low-cost housing schemes;

(iii) to promote domestic capabilities especially in those areas and works where foreign contractors do not show particular interest;

(iv) to encourage horizontal and vertical subcontracting by means of instructions and subsidies;

(v) to divide major projects by leaving it to interested firms of different sizes and capabilities to apply either for specific works or for the whole project (combined slice and package approach);

(vi) to decrease foreign firms' foreign exchange quotas and to persuade them to employ local contractors and materials wherever it appears reasonable.

(b) Financing

(i) to provide advance financing and progress payments promptly according to schedule and speedy settlements for completed projects;

(ii) to establish and to make funds available to special financial institutions which are to provide capital to domestic contractors and building materials producers for financing equity and credit such as working capital for advance financing of orders, finance for technical equipment and materials, deficiency guarantees and guarantees required by the applicants for tender and for other credits;

(iii) to set up and to take a share in the basic capital of machine pool companies in order to encourage hire purchase finance for technical equipment, including technical and organizational assistance and to provide smaller firms with equipment and make available special machinery for leasing;

(c) Training and Research

(i) to establish an inventory of training needs and to implement training schemes in the craft, technical, organizational and commercial fields by focussing on practical on-the-job methods and including special programmes for entrepreneurs and managers;

(ii) to develop domestic architectural and technical planning and design capacities by training professionals to work in consulting business and by getting foreign contractors and consultants to take on more training functions (mainly on-the-job training) and to integrate these activities into the construction process;

(iii) to establish new or to improve the performance of existing research facilities in the field of construction and building materials by strengthening their empirical orientation, their relationships with the business community and those departments which deal with the economic implications of technical research findings. Periodical inquiry survey systems might be initiated and organized with the business community on short and medium term issues, problems and development prospects.

(d) Building materials and technical equipment

(i) to extend the utilization of traditional building materials and to improve their technical specifications by up-grading, thereby reducing the dependency on expensive foreign currency consuming imports;

(ii) to find out under which conditions and at which prices known deposits of mineral raw materials could be exploited for construction purposes and to embark on prospecting and exploration of new deposits;

(iii) to promote the usage of vegetal fibres where available as building materials particularly in rural areas by up-grading their technical standards;

(iv) to assist in the development of markets for second-hand construction equipment and in gradually establishing a construction tools and equipment industry.

(e) Export promotion

Countries with rich resources in building materials may like to venture in exports. In those cases promotion policies should be set up which include, in particular, aspects of international standards and specifications, prefinancing in foreign currency for appropriate technical equipment, licenses and performance quarantees etc. The same applies to some advanced developing countries which may consider to promote foreign contracting. In addition, policies may be required with respect to joint ventures with foreign companies.

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