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THE CONSTRUCTION INDUSTRY IN DEVELOPING COUNTRIES

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PREFACE

This report is one of a series of publications which describe various studies undertaken under the sponsorship of the Technology Adaptation Program at the Massachusetts Institute of Technology.

In 1971 the United States Department of State, through the Agency for International Development, awarded the Massachusetts Institute of Technology a grant, the purpose of which was to provide support for the development at M.I.T., in conjunction with institutions in selected developing countries, of capabilities useful in the adaptation of technologies and problem-solving techniques to the needs of those countries. At M.I.T., the Technology Adaptation Program provides the means by which the long-term objective for which the A.I.D. grant was made, can be achieved.

This report presents a state-of-the-art review of the construction industry in the developing countries. It discusses the role of construction in the process of development and its importance to economic growth, employment creation, and income generation and redistribution.

The issues facing the growth of a viable indigenous construction industry in the developing world are considered within the context of the activities involved in the creation of constructed facilities -- planning, design, construction, and maintenance. The environment within which the industry has developed is also examined. For each construction activity the report reviews available capabilities, the various resources needed for the development of an indigenous industry, and some possible means of accommodating these needs.

In order to provide a specific focus for the discussions, the authors utilized information available on five emerging nations at different stages of development -- Colombia, Korea, Iran, Kenya, and Ethiopia. These countries differed not only in economic, social, and political structure and in their extent of development, but also presented a wide variation in the availability of natural resources.

The report reviews multi-national construction firms as a potential means for the transfer, adaptation, and development of appropriate technologies to less industrialized countries, considering the firms' nature, the scope of their activities, and their evolving role in the development process. Opportunities available to the developing countries for using the multi-nationals as a vehicle for the developmental process and possible incentives for such use are also discussed.

In the process of making this TAP-supported study, some insight has been gained into how appropriate technologies can be identified and adapted to the needs of developing countries per se, and it is expected that the recommendations developed will serve as a guide to other developing countries for the solution of similar problems which may be encountered there.

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SUMMARY

It is argued in this report that the construction industry plays a major role in economic development in the less industrialized nations since it constitutes a significant portion of both gross national product and of employment. Indeed, the creation of physical facilities constitutes more than one-half of the gross domestic investment of both developed and developing nations. The construction industry also plays a key role in satisfying a wide range of physical, economic, and social needs and contributes significantly to the fulfillment of various major national goals. The industry's size, the nature of its operation, and its presence in every developmental activity make it an attractive area for the transfer, adaptation, and development of technologies consistant with the developmental goals of emerging nations.

The planning issues facing the development of the construction industry include (1) the availability of local planning capabilities and the nature of the information base necessary for a sound planning analysis, and (2) the financing of the construction project, the various bilateral and multilateral aid and loan sources and their availability, and the constraints each imposes on the construction process. The report sets forth the argument that local planning capabilities may be substantially increased by the use of computer planning techniques; the financing of construction appears to be a major source of complications in the selection and development of appropriate construction technology.

Major issues in the design stage include the shortage of experienced manpower and the role that design plays in dictating construction

technology. Education, the use of computerized design techniques, and standardization of designs are suggested as possible means of increasing the design capabilities of the developing countries. Increasing designer's sensitivity to local conditions, and the use of plans, specifications, and building codes which are performance based could encourage the development and use of design strategies more compatible with local needs and conditions than is currently the case.

In the construction phase the issues are divided into and discussed in four resource categories -- management, capital, labor, and materials. Management manpower is in very short supply in almost all developing nations, and management training and education is time-consuming and difficult because it relies primarily on on-the-job training. The development of local educational centers, the use of expatriates as a training mechanism, and the use of computers are suggested as possible means of alleviating the problem of educating local managers. In addition, contractual arrangements, bidding practices, and the manner of selecting contractors all require substantial improvement.

Financing problems arise both for working and investment capital. High interest rates, lack of adequate credit with equipment and materials suppliers, the unavailability of rental equipment, lengthy delays in payments, and the practice of withholding a portion of the payment as a guarantee against poor workmanship are serious issues facing local contractors in most developing countries.

The issues involved in manpower requirements for the construction phase have been of most interest to development economists. The abundance of labor in developing countries and the labor-intensive nature of construction activities have led many researchers to investigate the possibility of substituting labor for capital in certain areas of construction. The immobility of the labor force and the remoteness of many construction sites from population centers, however, coupled with the erratic availability of labor because of a seasonal return to agricultural production, workers' poor health and inadequate nutrition, their lack of industrial discipline and low productivity, and the fact that many construction activities require highly trained workers all appear to be impediments to labor substitution.

The developing countries are concerned also with construction materials -- their availability in local markets, their production at the local level, and their quality and its control. Many building materials such as cement and steel are bulky, and their price is sensitive to both the scale of production and to transportation costs. The development of local building materials industries, therefore, is subject to the availability of manpower, capital, markets, and necessary raw materials.

The maintenance of constructed facilities generally is considered a low priority item in developing countries, a fact which results in substantial losses in revenue and in a reduced life for the facility. Maintenance, however, is a highly labor-intensive activity which, if properly organized and administered, may result in substantial employment for a rather unskilled group of laborers. Closely associated with the question of maintenance is that of the staging of construction, a process which can result in the more effective use of resources as well as in reduced costs.

The regulatory environment within which the construction industry operates is extensive. Building and related codes are generally procedural rather than performance based and are often borrowed from the developed countries with little or no modification for local conditions. The establishment in the emerging nations of some type of centralized agencies or institutes, like those in Europe, to develop building and related codes, to encourage, support, and perform research in the area of construction, and to collect, evaluate, and disseminate information to the industry is suggested as a possible means of alleviating some of the difficulties in this area.

As far as the role of multi-national construction firms in the process of development is concerned, a brief overview of their nature and organization is followed by a review of their current operations in developing countries and an examination of their potential as a vehicle for the transfer, adaptation, and development of technologies appropriate to local conditions in specific emerging nations.

Joint venturing with or subcontracting to local firms are alternatives to multi-nationals working alone in the construction of facilities in developing countries. Joint venturing and subcontracting normally involve educating unskilled laborers and the development of middle management on the local level, and for this reason they are important elements in the growth of an indigenous construction industry.

The report makes several suggestions aimed at encouraging the multi-nationals to respond more directly to the needs of a developing country for manpower training and using technologies appropriate to local conditions. These suggestions include both restrictions that require, and economic incentives that encourage, joint venturing or subcontracting, the use and training of local manpower, and the use of local materials and equipment. In the construction phase, for example, the contractor may be required to guarantee a minimum level of local employment, a minimum level of involvement of local contractors or subcontractors, a maximum value of expatriate salaries, and so forth. The possiblity of providing some job continuity for multi-nationals is suggested as an additional incentive to encourage the establishment of more permanent local offices and the fuller utilization of local resources. In addition, the role of the government in stabilizing construction demand through the national planning of construction is discussed.

CHAPTER 1

INTRODUCTION

A major problem facing the world during the remainder of the twentieth century is the narrowing of the economic gap between the developed and the developing nations. Unfortunately, the developed countries, already far ahead in per capita income, are drawing still further away from the less developed nations, thus worsening an already explosive situation.

Although economic and social change in the developing countries depends primarily upon the actions of the people and their governments, the cooperation of the developed countries, especially through bilateral and multilateral financial and technical assistance and other cooperative arrangements, is vital. In recent years the nature of this cooperation, its objectives and goals, and its modes of operation have been reexamined by many institutions concerned with international assistance programs. It has become clear, for example, that financial assistance in support of a single spectacular project will not contribute significantly to the development program of a country; in many instances the operation and maintenance of the project may simply drain the limited resources of the local government. It is generally agreed that the role of international assistance programs should be shifted more toward institution building in developing countries and less toward single, short-term spectacular projects. This shift in emphasis requires an understanding of the political and social structures of developing nations as well as the economic and technical resources available in various sectors of the economy.

One major sector of the economy which is receiving increasing attention as a possible area for the development of better institutional structure in the emerging nations is construction, an industry present in every developmental activity. Construction contributes to economic development by satisfying some of the basic objectives of development including output generation, employment creation, and income generation and re-distribution. It also plays a major role in satisfying basic physical and social needs, including the production of shelter, infrastructure, and consumer goods.

1.1 Construction and National Development

A major objective of development is economic growth. During the early developmental process economic growth seems to be generally high, and construction, along with manufacturing, tends to play an increasingly important role in the economy while agriculture's importance declines; once a relatively high level of development is achieved, however, economic growth appears to slow, and construction's role tends to stabilize or even decline slightly while the other sectors continue as before.

While construction's direct contributions to development are significant, it also stimulates a sizeable amount of economic growth through backward and forward linkages. Construction's requirements for goods and services from other industries are considerable; the development of the construction industry therefore stimulates these ancillary industries, thus encouraging further economic growth. In developing countries the construction of physical facilities makes up more than one half of gross domestic investment and tends to be concentrated on basic infrastructure in agriculture, mining, transportation, communication, and utilities. Infrastructural services make some contribution to GDP, but they also stimulate the development of other industries which, in turn, contribute more directly to economic growth. Once the basic infrastructure is created, more effort can be devoted to construction for manufacturing, commerce, and services and to the building of dwellings and institutional facilities.

Construction's contributions to employment creation are naturally parallel to its contributions to output generation. A common condition of underdevelopment is unemployment and underemployment. In the past, the question of employment was generally neglected because of the apparent conflict between economic growth and employment creation. The extent to which growth and employment creation should be balanced in developing countries is a matter of importance and necessarily depends largely upon local economic, technical, social, and political conditions. The construction industry could play an important role in resolving this conflict because it is technologically flexible, implying that many of its operations can be made more or less labor-intensive depending upon conditions in the country at the time.

Closely aligned with the question of employment creation is that of income generation and re-distribution. A usual concomitant of underdevelopment is low per capita income, a condition generally made even more serious by the accompanying inequitable income distribution.* Through the many direct and indirect means by which construction creates employment it also generates income. Since the construction indus-

*See Table A1.1 in Appendix A.

try as a whole is largely made up of small firms, it provides entrepreneurial opportunities for many small businessmen, thereby helping to re-distribute income. The workers who are employed in construction itself, however, may not do so well since wages in less industrialized nations are low. In the early stages of development wages in construction grow more slowly than those in manufacturing, although as development progresses they tend to rise faster than those in manufacturing and soon to exceed them.

Construction plays a vital role in economic growth and development, but it is also important in terms of satisfying basic physical and social needs, the first of which is shelter. The standard of housing is an important component in a nation's welfare, and at least 35 percent of all construction in a typical developing country is in the form of dwellings. In many of these nations, however, the existing problem of providing adequate housing worsens as development progresses because the population tends to move from rural to urban areas. A possible range of solutions proposed to alleviate these and other housing problems include measures such as the following: (1) the development and construction of low-cost housing for sale or rental; (2) arrangements for low-cost credits or subsidies; (3) material and technical aid for families undertaking self-help construction; (4) nationalization of the construction and building materials industries and operations; and (5) the development and use of efficient construction techniques suitable for using locally available labor, materials, and equipment. An additional possibility might be the channeling of limited resources into the upkeep and improvement of the existing housing stock.

Closely related to society's need for shelter is its need for basic infrastructural services such as water supply, waste disposal, power, transportation, and communications. Community development also involves establishing various institutional, commercial, and manufacturing services. Since it is the construction industry which creates the physical facilities required to meet these varied social needs, construction thus has an important impact on social as well as economic growth and development.

Although construction plays a vital role in achieving balanced economic and social development, few national development plans explicitly consider construction in terms of defining targets or considering the industry's relation to other sectors of the economy. An examination of more than forty development plans for countries at various stages of economic growth in the mid-sixties revealed only a limited consideration of the role of construction (2). Development plans in general are concerned largely with the public sector. While they may devote one or more sections to social programs and others to transportation, communication, or general infrastructure, they do not establish the construction required to meet these targeted needs. Their concern with industrial development also is often limited, and cement is usually the only building material to receive any attention.

1.2 Purpose and Scope of the Report

The purpose of this report is to provide a state-of-the-art review of the construction industry in developing countries, and to identify the potentials and the barriers that exist for the transfer, adaptation, and development of an indigenous industry.

Chapter 2 identifies the role that the construction industry has played and continues to play in the development process by examining its impacts on and its contributions to the economic development of less industrialized nations. The issues facing the growth of the industry in these countries are reviewed in Chapter 3 within the context of the major activities involved in the production of constructed facilities--planning, design, construction, and maintenance. Chapter 4 examines the role of multi-national firms in construction as an example of the mechanisms available for the transfer, adaptation, and development of technology in emerging nations. It reviews the role these firms have played and continue to play in providing developing nations with assistance in acquiring the basic technology of construction. Chapter 5 concludes the report with a summary and some recommendations.

This report relies largely upon available literature for its data, although the investigators contacted a few firms in the industry. While much of the report is directed at developing countries in general, our efforts particularly in the area of data collection were concentrated on five emerging nations at different stages of development. These include Colombia, Korea, Iran, Kenya, and Ethiopia; and they offer a good cross-section of developing countries in terms both of their current stages of economic growth and of the natural resources available to them.

CHAPTER 2

THE ROLE OF CONSTRUCTION IN ECONOMIC DEVELOPMENT

The construction industry in both developed and developing countries may be viewed as that sector of the economy which, through planning, design, construction, maintenance and repair, and operation, transforms various resources into constructed facilities. The types of public and private facilities produced range from residential and nonresidential buildings to heavy construction, and these physical facilities play a critical and highly visible role in the process of development.

The major participants from the construction industry include the architects, engineers, management consultants, general contractors, heavy construction contractors, special trade contractors or subcontractors, and construction workers, along with the owners, operators, and users of the constructed facility. Building finance and insurance agencies, land developers, real estate brokers, and material and equipment suppliers and manufacturers, among others, are also involved in construction but are generally considered as distinct from but ancillary to the construction industry. The government interacts with the industry as purchaser, financier, regulator, and adjudicator. The regulatory environment within which the construction industry operates is also important and includes, for example, building and related codes, licensing requirements, safety legislation, and financial institution operating rules.

Most developing, as well as developed, countries put over 55 percent of their gross domestic investment into the creation of the physical facilities, including infrastructure, so necessary for development (10,26). Moreover, the construction industry plays a key role in satisfying a wide range of physical, economic, and social needs and contributes significantly to the fulfillment of various major national goals. The industry's size, the nature of its operation, and its presence in every developmental activity have made construction an attractive area for experimentation in enhancing the effectiveness of international assistance and cooperative works.

2.1 Construction's Role in the Economy

A major difficulty in doing a quantitative study of the construction industry is a lack of accurate, detailed, and comparable data. In large part, this is due to the diverse nature of the industry in terms of, for example, its large size; fragmentation; geographic and product-type dispersion; reliance on a labor force, materials, and equipment which are widely used by other industries; and its association with numerous ancillary industries. In developing countries in particular a fluctuating demand market, which may be distorted by single but large projects and construction's sensitivity to political and economic uncertainty, impair statistics, along with the fact that it is difficult to determine the contribution of the non-monetary sector of construction. These difficulties are further compounded by the general lack of statistics on developing countries and the problem of incomparability of data collected on different countries. Nonetheless, enough statistics are available to draw tentative conclusions, particularly about the significance of the industry and its role in the economy of both developed and developing countries.

It should first be noted that the world resources for construction are very unevenly distributed among countries at different economic levels (see Table 2.1). Countries with a per capita gross national product (GNP) of 700 dollars or more accounted for nearly 88 percent of construction in the world in 1965. In that year nearly 40 percent of the world's gross domestic capital formation (GDCF) in construction of 230 billion dollars was in North America alone. The data also show a strong positive correlation between the per capita value added in construction and per capita gross domestic product (GDP) (see Figure 2.1). A similar relationship seems to hold for per capita GDCF in construction and per capita GDP, although here it is per capita total GDCF which increases with increasing per capita GDP and not construction's share in total GDCF (23, 26).

Figure 2.1 also suggests that construction's share in GDP tends to increase with increasing per capita GDP. According to a United Nations' study (22), value added in construction represents between 3 and 5 percent of the GDP in most developing countries and between 5 and 9 percent in most developed ones. Table 2.2 substantiates this and further suggests that on the average construction's share over the years in developed countries has been falling while it has been rising in developing countries. The indexes in Figures 2.2a and 2.2b also indicate that in developing market economies, since 1960, construction has tended to grow somewhat faster than GDP with especially significant growth since the mid-sixties; essentially the opposite trend is exhibited by developed market economies. An index for all market economies follows the developed countries' trends since they do such a large share of the world's construction and have such a large share of the world's GDP (see Figure A2.1*). Moreover, since the mid-sixties, economic growth in the developing market economies has been significantly higher than that in de-

*Figures or tables with prefix "A" are in Appendix A.

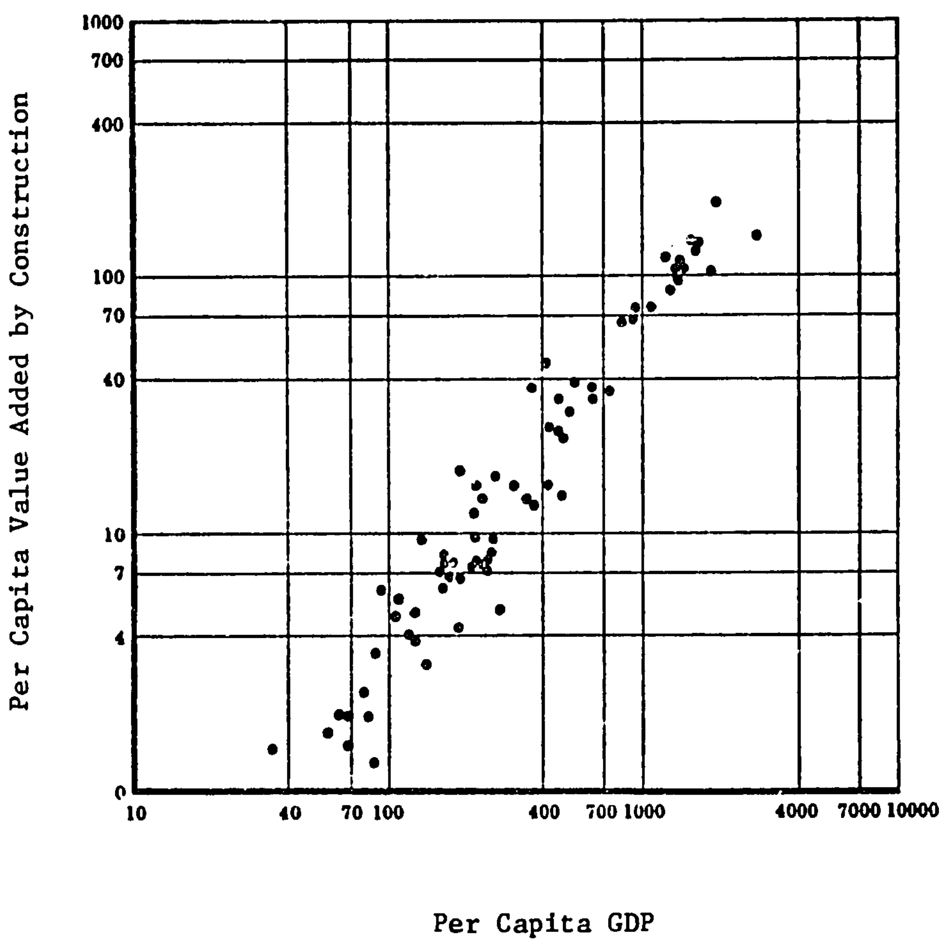
Table 2.1: World estimates[a], by income groups and by regions, of (a) value added in construction and (b) gross domestic capital formation in construction, for 1965 (billions of U.S. dollars) (source: ref. 23)

Income groups by range of per capita GNP in U.S. dollars	North America		Oceania		Western Europe		Eastern Europe		Latin America		Middle East		Asia		Africa		Total all regions		Percentage of world total	
	(a)	(b)	(a)	(b)		(b)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)	(a)	(b)
I. 2,000+	34.2	90.7			2.2	5.1					0.1[b]	0.2[b]					36.5	96.0	33.4	41.8
II. 700-2,000			1.8	3.2	27.4	48.8	23.9[b]	41.8[b]	1.2	2.7	0.3	0.6	4.8	8.9			59.4	106.0	54.3	46.1
III. 400-700					1.3	3.1	1.3[b]	2.4[b]	1.0	2.1	---	0.1[b]	0.1[b]	0.2[b]	0.7	1.2	4.4	9.1	4.0	4.0
IV. 120-400					0.6	1.1	---	---	1.2	2.5	0.2[b]	0.3[b]	0.8	1.6	0.6	1.3	3.4	6.8	3.1	3.0
V. under 120									---	---	---	---	5.2[b]	10.9[b]	0.5	1.0[b]	5.7	11.9	5.2	5.2
TOTAL ALL GROUPS	34.2	90.7	1.8	3.2	31.5	58.1	25.2	44.2	3.4	7.3	0.6	1.2	10.9	21.6	1.8	3.5	109.4	229.8	100.0	100.0
Percentage of world total	31.3	39.5	1.6	1.4	28.8	25.3	23.0	19.2	3.1	3.2	0.6	0.5	10.0	9.4	1.6	1.5	100.0	100.0		

[a]Data relate to 75 countries.

[b]Crude estimate.

Figure 2.1: Per capita value added by construction[a] and per capita GDP, 1963 (U.S. dollars) (source: ref. 23)



[a]Average percentage contribution of construction to GDP 1960-1965 multiplied by per capita GDP in 1963.

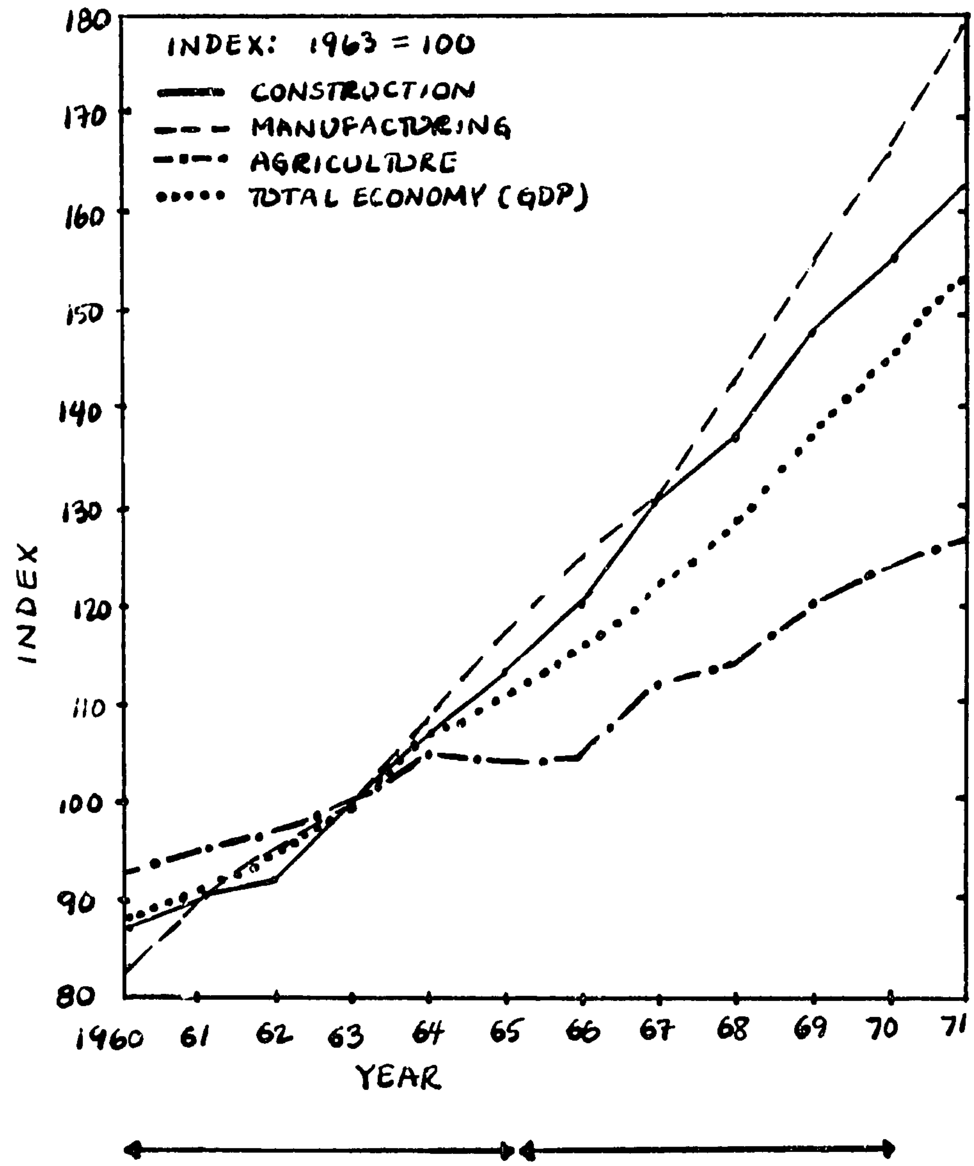
Table 2.2 : GDP and its distribution among various sectors of the economy, by economic grouping, for 1953 to 1968 (source: ref. 25, 29)

Economic grouping and year	GDP in purchaser's values[a] (billions of U.S. dollars)	Per capita GDP in purchaser's values[a] (U.S. dollars)	Average percentage distribution of GDP among the sectors of the economy[b]			
			Primary	Secondary		Tertiary
				Construction	Manufacturing	
Developing market economies						
1953-1955	na	na	42.1	3.6	14.2	40.1
1959-1961	184.1	140	39.8	3.7	15.7	40.8
1966-1968	295.1	180	36.1	4.0	17.4	42.5
Developed market economies						
1953-1955	na	na	12.3	6.0	28.9	52.8
1959-1961	943.7	1500	11.6	5.9	29.1	53.4
1966-1968	1618.1	2370	10.2	5.6	31.1	53.1

[a]For middle years -- that is 1954, 1960 and 1967.

[b]The percentage share is calculated on the basis of a three-year average of GDP at constant factor cost. The primary sector includes agriculture, forestry, and fishing; mining and quarrying; and electricity, gas, and water. The secondary sector includes manufacturing and construction. The tertiary sector includes commerce; transport, storage, and communication; services; and all other not included elsewhere

Figure 2.2a: Index numbers of GDP[a], for the economy as a whole and certain sectors, in developing market economies (source: ref. 30)

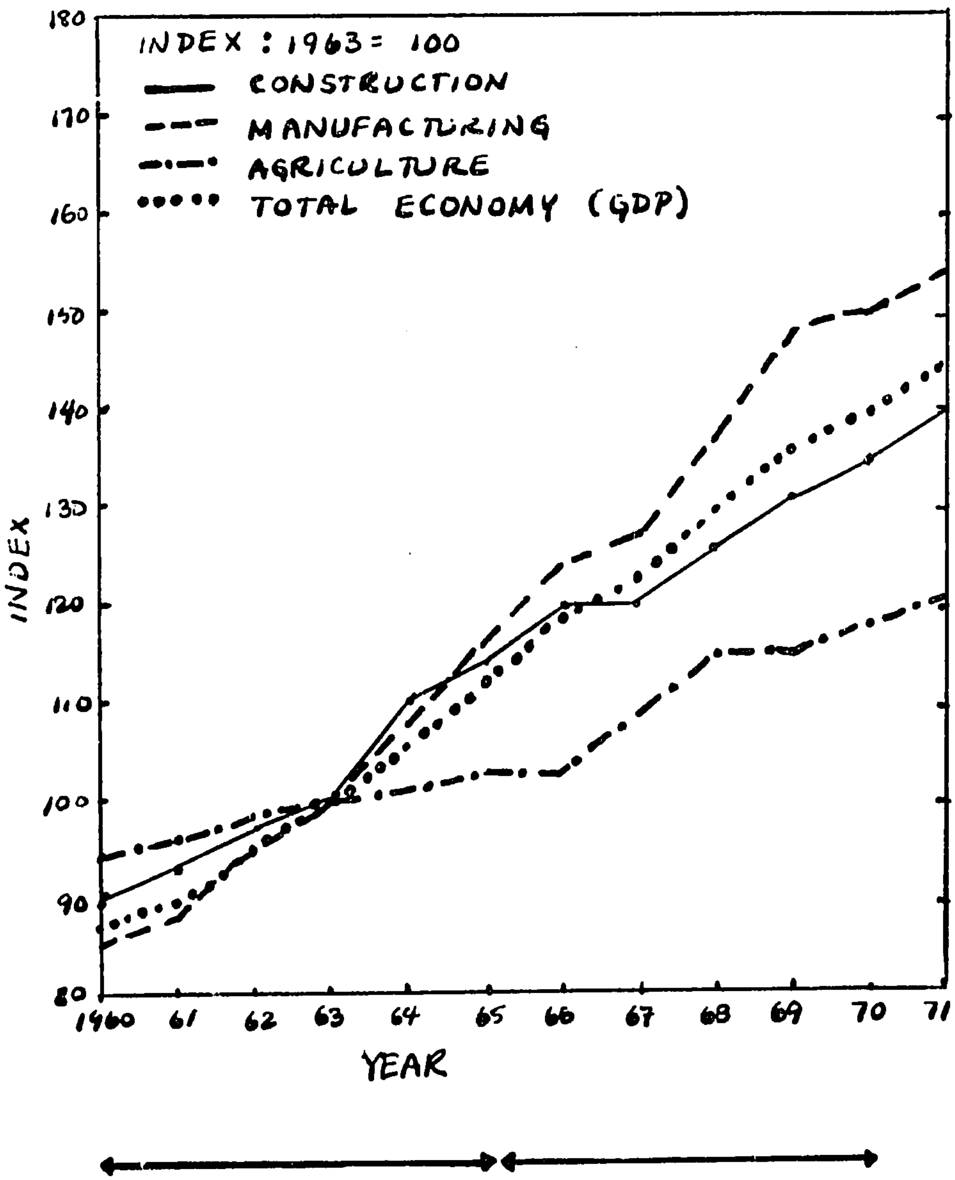


GDP	5.0	5.7
Construction	5.7	6.7
Manufacturing	7.0	7.4
Agriculture	2.4	3.8

[a]Index numbers were compiled as weighted averages of country indexes of gross product at 1963 prices. The country indexes were generally derived from official estimates of GDP at constant prices by kind of economic activity in terms of the former SNA.

*Average annual growth rates at constant prices (percent).

Figure 2.2b: Index numbers of GDP[a], for the economy as a whole and certain sectors, in developed market economies (source: ref. 30)



GDP	5.3	4.7
Construction	5.1	3.5
Manufacturing	6.6	5.5
Agriculture	1.9	3.0

[a]See footnote a in Figure 2.2a.

*Average annual growth rates at constant prices (percent).

veloped ones. Manufacturing and agriculture are included for purposes of comparison in the above tables and figures. Further, data for individual countries are given in Tables A2.1 and A2.2, and although they may not always agree with these generalizations, this does not invalidate them but rather demonstrates the caution that must be exercised in applying generalizations to specific countries and vice-versa.

In summary, it seems obvious that construction's role in economic growth is a significant one in both developing and developed countries. During the development process economic growth is high, and construction, along with manufacturing, plays an increasingly important role while agriculture's importance declines. Once a relatively high level of development is achieved, however, economic growth appears to slow a little, and construction's role stabilizes or even declines while the other sectors continue as before.

Construction's manpower requirements range from highly skilled professionals to completely unskilled laborers. In developing countries physical construction activities alone employ some 2 to 6 percent of the total labor force, while the ancillary operations provide an additional 2 to 4 percent. The corresponding figures for developed countries are 6 to 10 percent and 4 to 6 percent (5, 23). The data in Table 2.3a for twenty-seven countries at three different levels of development are in accord with this information, as are the data in Table 2.3b for three developing countries and the U.S. These figures also indicate that construction's share in employment has tended to increase over the years in the developing countries while remaining fairly stable in the U.S. It thus appears that construction's share in employment tends to follow the behavior of its share in the GDP. An International Labour Office report

Table 2.3a: Employment and its growth rate in construction and manufacturing, in terms of arithmetic means for twenty-seven countries and three subsets, 1955 to 1964 (source: ref. 18)

Economic grouping	Employment as share of economically active population (percent)		Growth rate of employment (percent)	
	Construction	Manufacturing	Construction	Manufacturing
Underdeveloped (12 countries)	3.9(10)	11.1(10)	1.3(9)	4.4(9)
Middle group (7 countries)	6.7	18.6	5.1(6)	2.9(6)
Developed (14 countries)	7.2	27.5	1.8(13)	1.6(13)
All (27 countries)	5.8(25)	20.4(25)	1.6(22)	2.7(23)

Note: Figures in parentheses indicate number of countries if less than total shown at beginning of row. Developed countries included in the sample, in descending order of income per head, are: the United States, Canada, Australia, Norway, the Federal Republic of Germany, the United Kingdom, France, Denmark, Belgium, the Netherlands, Austria, Finland*, Italy*, and Japan* Classified as underdeveloped are: Spain*, Jamaica*, Mexico*, Turkey, Peru, Honduras, El Salvador, Egypt, the Philippines, South Korea, Nigeria, and Kenya. The middle income countries are those marked with an asterisk above plus Puerto Rico.

Table 2.3b: The economically active population and its distribution among various branches of economic activity, for three developing countries and the U.S. (source: ref.7, 12, 28)

Country and year	Economically active population		Construction		Manufacturing		Agriculture	
	Number (thousands)	Percent of total population	Number (thousands)	Percent of e.a. population	Number (thousands)	Percent of e.a. population	Number (thousands)	Percent of e.a. population
Korea								
1972[a]	10,500	32.3	371	3.5	1,372	13.1	5,078	48.4
1966[a]	8,654	29.7	191	2.2	958	11.1	4,553	52.6
1960[b]	7,543	30.2	127	1.7	487	6.5	4,670	61.9
Iran								
1966[c]	7,584	30.2	510	6.7	1,268	16.7	3,169	41.8
1956	6,067	32.0	336	5.5	816	13.5	3,326	54.8
Colombia								
1970	5,938	28.1	316	5.3	808	13.6	2,670	45.0
1964	5,134	29.4	221	4.3	656	12.8	2,427	47.2
1951[d]	3,756	33.4	133	3.5	461	12.3	2,023	53.9
U.S.								
1972	88,991	42.6	5,728	6.4	21,022	23.6	3,701	4.2
1966	80,164	40.7	4,924	6.2	21,017	26.2	4,439	5.5
1960	69,877	39.0	4,302	6.2	18,536	26.5	4,519	6.5

[a]Economically active population figures exclude persons seeking work for the first time and armed forces.

[b]Economically active population figures exclude military personnel in barracks and 24,945 persons of status unknown.

[c]Excludes unsettled population of 244,141 persons.

[d]Excludes 127,980 Indian jungle population and population of certain localities (estimated at 191,683) where census not carried out.

(11) shows that construction's share of the industrial workers in developing countries is generally greater than that in developed ones, with a range in the former of 10 to 77 percent (median of 25 percent) and in the latter of 13 to 29 percent (median of 21 percent). This again appears to bear out the conclusions above about construction's and manufacturing's roles in GDP during development, although productivity may also play a part in this process.

The data in Table 2.3a show that the growth rate of employment in construction in developing countries is lower than that in developed countries; what is really striking in these figures, however, is the high growth rate in the middle group countries (see Table A2.3 for indexes of employment for two developing countries and the U.S.). This seems to accord with construction's changing importance during development and with the following characterization of a three-stage development process: (1) during the early stages, construction is largely by expatriate firms using a reasonably high level of technology and thus rather capital-intensive; (2) as growth progresses and local industry develops, so do intermediate technologies of a more labor-intensive nature; and (3) as a relatively high level of development is achieved and labor becomes more expensive, local technology probably becomes more capital-intensive. Manufacturing's trend of a high initial employment growth rate which declines as development progresses seems explicable mainly in terms of labor productivity.

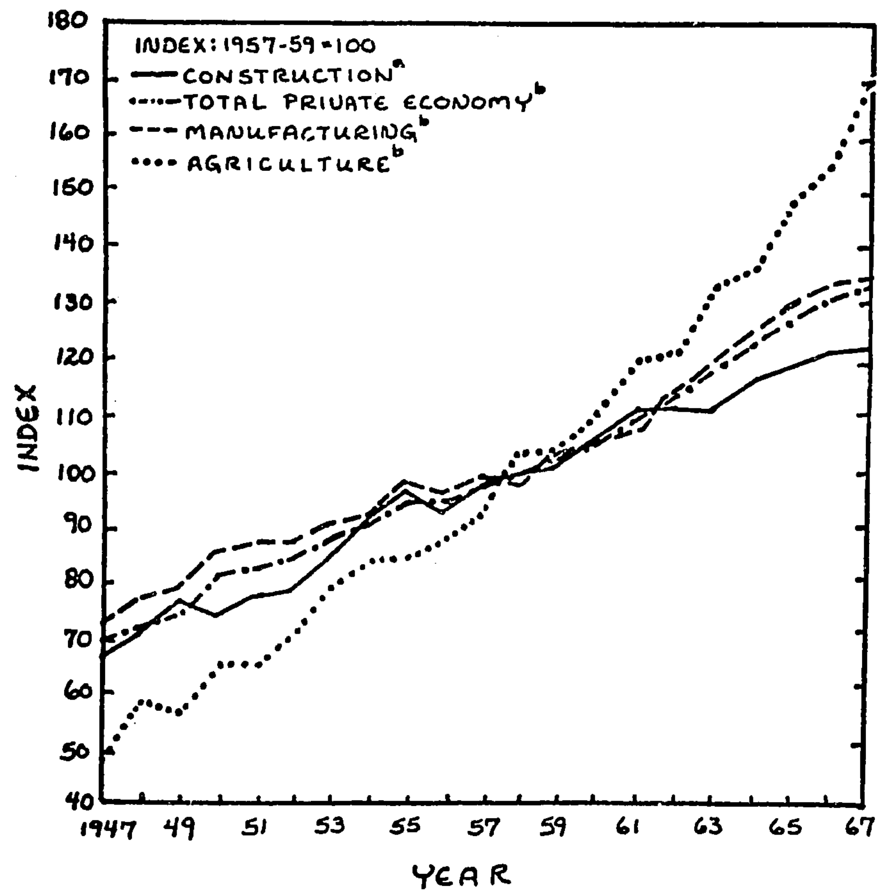
Construction's share in the economically active population is generally larger than its share in the GDP in both developing and developed countries, suggesting that its labor productivity is less than that of the economy as a whole. Moreover, comparing the ratio of construction's share in GDP to its share in employment with the same ratios for manufacturing and agriculture indicates that labor productivity in construction is much less than that in manufacturing but somewhat more than that in agriculture. Thus, construction in both developing and developed countries is generally a quite highly labor-intensive industry; the data in Table 2.4 support this conclusion and suggest that construction is relatively more labor-intensive in developing than in developed countries. In light of this information, it seems reasonable to expect labor productivity to grow faster in manufacturing than in construction thoughout the development process; Figure 2.3 shows that this has generally been the case in the U.S. A frequent explanation for this situation is the general unsuitability of many construction processes to automation and mechanization and the ever-changing nature of the product.

It thus seems clear that construction, a rather labor-intensive industry, plays a significant role in employment. It also plays a significant role in unemployment, however, with its share being two to three times the national average in both developing and developed countries (5, 23). A number of factors account for this, including the seasonal nature of the work, the industry's reliance on a floating labor force, and demand market fluctuations. The government in some developed countries has taken steps to alleviate this job insecurity, but, more importantly, labor unions have developed and take an active part in influencing training and hiring procedures in the industry. Partly as compensation for poor work conditions and partly due to the bargaining power of the labor unions, among other reasons, wages in construction in developed countries are generally higher than those in manufacturing (see Table 2.5). This is not true in developing countries, however, where labor unions are just beginning to develop (23). Yet, as deve-

Table 2.4: Indicators of labor intensity in various branches of economic activity, for certain developing and developed countries (persons engaged per unit of value added, manufacturing = 100) (source: ref. 11)

Country	Construction	Mining and quarrying
Developing countries:		
Algeria (1954)	148	65
Malawi (1961)	170	-
Morocco (1961)	209	90
Tunisia (1962)	307	77
United Arab Republic (1961/62)	191	50
Zambia (1963)	227	36
Honduras (1960)	179	57
Jamaica (1960)	102	7
Mexico (1960)	85	69
Trinidad and Tobago (1957)	244	29
Brazil (1949)	121	154
Venezuela (1953)	26	57
China (Taiwan)(1962)	645	334
Israel (1963)	151	69
Malta (1961)	89	135
North America and Europe:		
Canada (1961)	100	-
United States (1958)	161	-
Germany (Fed. Rep.)(1962)	111	111
Ireland (1963)	145	102
Italy (1962)	141	94
Netherlands (1962)	143	88
United Kingdom (1958)	126	115
Yugoslavia (1964)	139	130

Figure 2.3: Indexes of labor productivity (output per man-hour), for the total private economy and various economic activities, in the U.S. (source: ref. 4)



[a]Based on Cassimatis' derived deflator (he used a weighted average of three indexes to arrive at his derived deflator which he then used to determine real output and from that labor productivity).

[b]Based on U.S. Bureau of Labor Statistics data.

Table 2.5: Average hourly earnings and their growth rate in construction and manufacturing, in terms of arithmetic means for twenty-seven countries and three subsets, 1955 to 1964 (source: ref. 18)

Economic grouping	Average hourly earnings (1963 U.S. dollars)		Growth rate of average hourly earnings (percent)	
	Construction	Manufacturing	Construction	Manufacturing
Underdeveloped (12 countries)	0.23	0.23	2.8(7)	3.9(7)
Middle Group (7 countries)	0.42(6)	0.39(6)	5.8(5)	4.8(5)
Developed (14 countries)	1.10	0.90	3.9(12)	3.7(13)
All (27 countries)	0.71	0.61	3.8(19)	3.8(20)

Note: See note in Table 2.3a.

lopment does progress and construction's need for labor increases along with that of other sectors of the economy, wages in construction tend to rise faster than those in manufacturing and soon exceed them.

In examining other inputs to the construction process, it seems useful to begin by considering the value added in construction as a share of construction output for different levels of development. Referring to Table 2.1, the ratio of value added in construction to GDCF in construction is 38 percent for the top income group, 56 percent for the second one, and 48 to 50 percent for the bottom three groups. This can possibly be explained by considering the three stages of development mentioned above.

In the bottom income groups, construction is probably largely by expatriate firms, using a reasonably high level of technology resulting in fairly mechanized production and low labor requirements and using expensive imported materials. The outcome is a relatively low value added. In the middle income group, development has progressed to the point where construction is probably by local firms using intermediate technologies of a more labor-intensive nature with local materials produced by the locally developing building materials industries. The result is a very high value added. Finally, in the top income group, labor has probably become increasingly costly as competition has increased with industrialization and technology has advanced to a highly mechanized stage with low labor requirements and mostly prefabricated building materials. The outcome is a very low value added. The profiles of construction inputs in a typical developing and developed country given in Table 2.6 seem to support this hypothesis.

Table 2.6 shows that 60 percent of the material input in construction in developing countries is imported, and 30 percent of the total value of construction is these imports and their transport. In many

Table 2.6: Typical profiles of construction inputs, in a developing and developed country, in the early sixties (gross value of production is 100 units) (source: ref. 23)

Inputs	Developing country[a]			Developed country[b]		
	Domestic	Imports	Total	Domestic	Imports	Total
Inputs from agriculture, forestry, mining, quarrying, manufacturing	16	24	40	25	8	33
Fuel, power, electricity, gas water	1	1	2	1	-	1
Other service inputs, including transport	8	5	13	7	1	8
TOTAL VALUE OF INTERMEDIATE INPUTS	25	30	55	33	9	42
Wages, salaries, associates expenditure	28	3	31	43	-	43
Amortization of plant and equipment, rentals paid	-	2	2	2	1	3
Indirect taxes less subsidies	2	-	2	2	-	2
Other gross business income	8	2	10	10	-	10
TOTAL GROSS VALUE OF PRODUCTION	63	37	100	90	10	100

[a] Typical of a less developed country in Africa or Asia with a per capita GNP of about $100.

[b] Typical of a Western European country with a per capita GNP of about $1200. Per capita value of construction of modern buildings in this country is about twenty times that in the representative developing country.

developing countries the value of imported building materials is between 5 and 8 percent of the total value of imports, while expenditure on building materials is only between 3 and 5 percent of the GDP (22). Building materials thus seem to use up a disproportionate share of foreign exchange. These facts have generated substantial interest in the development of local building materials industries and the development of construction technologies that could utilize existing local materials. In light of this, it is of interest to note that value added as a share of output varies widely for building materials, suggesting some are likely more suitable than others for developing countries to consider establishing (see Table 2.7).

One final point to consider when examining construction's role in the economy is the nature of the product itself. The types of constructed facilities produced by a developing country are naturally somewhat different than those produced by a developed one. Table 2.8 indicates that a country in the early stages of development tends to devote a greater share of its resources to new work, partly because facilities in existence are fewer in number and generally newer, and partly because there tends to be little emphasis on the importance of maintenance. A developing country, moreover, tends to concentrate on the construction of basic infrastructure in agriculture, mining, transportation, communication, and utilities, generally with the government as the client. Once the basic infrastructure is developed, more effort can be devoted to construction for manufacturing, commerce, and services and to the building of dwellings and institutional facilities, much of which is private work (see Table A2.4 for similar data on individual developing countries and the U.S.).

Table 2.7: Value added as a percentage of output for selected groups of building materials (source: ref. 22)

Building Material	Average percentage value added
Clay Products	59
Steel Manufacture	49
Concrete Products	45
Metal Frames	45
Cement	43
Sawnwood	38
Asbestos-Cement	38
Wood-Based Sheet	36
Wire, Wire Products	30
Bolts, Nuts, Screws, etc.	30
Paint and Varnish	29
Tubes and Pipes (Steel)	28

Table 2.8: Typical profiles of construction output, in a developing and developed country, in the early sixties (total output is 100 units) (source: ref. 23)

Sector acquiring output	Total of new work, repair and maintenance	New work			Repair and maintenance		
		Public	Private	Total	Public	Private	Total
Developing country[a]:							
Agriculture, fishing, forestry, mining, quarrying	11	2.2	8.0	10.2	0.1	0.7	0.8
Manufacturing, including construction	12	2.4	9.0	11.4	0.1	0.5	0.6
Trade, commerce, other private services	5	0.5	4.0	4.5	-	0.5	0.5
Transport, communications, roads, other public services	24	16.0	-	16.0	8.0	-	8.0
Utilities - gas, electricity, water	7	6.6	-	6.6	0.4	-	0.4
Dwellings	35	0.3	31.5	31.8	-	3.2	3.2
Education	3	2.1	0.7	2.8	0.2	-	0.2
Health and welfare	3	2.3	0.5	2.8	0.2	-	0.2
TOTALS	100	32.4	53.7	86.1	9.0	4.9	13.9
Developed country[b]:							
Agriculture, fishing, forestry, mining, quarrying	3	0.6	1.7	2.3	0.1	0.6	0.7
Manufacturing, including construction	14	-	8.0	8.0	-	6.0	6.0
Trade, commerce, other private services	12	-	9.7	9.7	-	2.3	2.3
Transport, communications, roads, other public services	17	9.5	0.5	10.0	6.7	0.3	7.0
Utilities - gas, electricity, water	6	3.6	0.4	4.0	1.9	0.1	2.0
Dwellings	40	13.0	13.0	26.0	3.0	11.0	14.0
Education	5	3.7	0.3	4.0	0.9	0.1	1.0
Health and welfare	3	2.2	0.1	2.3	0.7	-	0.7
TOTALS	100	32.6	33.7	66.3	13.3	20.4	33.7

[a]See footnote a in Table 2.6.

[b]See footnote b in Table 2.6.

One can then conclude that construction is an important sector of the economy. It makes significant direct contributions to the GDP and employment and less direct contributions through its requirements of ancillary industries. Perhaps even more importantly, however, construction is not an end in itself. The industry plays a major role in satisfying many physical facility needs of society. In the long run, the construction industry also has a significant influence on the overall ability of other industries to produce and distribute goods and services for consumers. In this manner construction has a most important impact on social and economic growth and development.

2.2 The Nature of Construction

The characteristics of construction products, including their custom-built nature, immobility, costliness, complexity, and continuously changing technology, set construction apart from many other industries in both developing and developed countries. Most construction activity is initiated by sources outside the industry itself, which enters the picture to begin production only after the customer has determined his need for a facility and has decided to procure it. In this respect construction is very much like a service industry. Only a few manufacturing industries, those which produce heavy durable goods of a specialized nature, customarily operate in this manner, and they normally produce other lines for a general trade to assure some constancy of operation.

Moreover, the procedure for the financing of production in construction is somewhat unique. In most industries, production is financed by the producer's entrepreneurial capital or short-term bank loans and is independent of the customer and product. In construction, however, the production of a specific facility is financed largely by the customer, rather than by the manufacturer, by periodic payments to the producer during production. Furthermore, the source of the customer's temporary (short term--for production) and permanent (long term--for purchase) financing is often loans secured by the constructed facility itself, which puts the lender in a potentially influential position regarding design and construction operations. This factor is particularly significant in the case of developing countries, where the financing of major projects is often largely by international agencies which can, and do, put numerous stipulations on their loans, such as requiring competitive bidding or financing only the foreign exchange portion of the project. Finally, the temporary loans are often dependent upon the client's first obtaining a permanent financing commitment.

The immobility of the construction product, which requires final assembly at the place of ultimate use, sets construction further apart from many industries, although as prefabrication increases some of these features will change. Since constructed facilities cannot be transported, the stability of local demand is of particular importance. Moreover, stockpiling of constructed facilities in inventories is impossible, and thus there is no buffer between production and demand.

The specialized character of each facility, the project-oriented nature of production, seasonality, and the industry's susceptibility to economic fluctuations and demographic influences all combine to make construction demand inherently unstable. Public policy often tends to augment this instability, and in developing countries unstable economic and political environments and single short-term spectacular projects further exacerbate the problem. In line with this instability, the construction labor force is generally a floating rather than a permanent one, and construction workers are hired largely on a project-by-project basis, resulting in little job security and the need for mobility. In developing countries employment in construction is often considered a transitional stage between work in agriculture and in manufacturing, or the worker may divide his time seasonally between construction and agriculture.

To better understand the nature of construction it is useful to look at the construction process itself, a complex procedure involving a variety of steps and participants. These participants are traditionally divided into three groups, the client, the professional, and the contractor sectors, an arrangement which is quite different from that in manufacturing where the designer and producer are in a single sector and the client enters only at the end. The participants, each generally from an independent organization and selected on the basis of price and/or qualifications, are gathered together on a project-by-project basis with little or no provision for insuring organizational compatibility and with little room for continuity of working relationships. Furthermore, each participant is generally brought into the project only when needed, serving to curtail feedback and the consideration of new alternatives in the later stages of the project, and constraining participants to work within the bounds of decisions in which they had no part.

The owner, who may be an individual, a corporation, a branch of the government, or some other private or public organization, combines with planners, investors, and developers to form the client sector, which initiates and finances the project. The client's job is to establish the need for a new facility, define facility requirements and budgetary constraints, evaluate and select the site, and so forth. This process necessarily becomes more complicated when the owner is not an individual (which means he is probably spending others' money), when he is not the user (which makes evaluation of user needs more difficult), or when he is not the operator (which may result in the costs of operation and maintenance receiving insufficient consideration). Owners who build a lot and many public agencies have an in-house design team or a long-term arrangement with a group of designers, while most others must find a designer to develop and then a contractor to construct their facility. The client's activities throughout the remainder of the construction process primarily involve the assessment and approval of the activities of the other participants, although some of these responsibilities are often delegated to the professionals on the project.

The role of the government in construction in developing and developed countries is important and varied. Governmental departments concerned with construction as a client, such as transport, communications, and health, education, and welfare, along with the major public utilities in developing countries, are frequently well staffed and technically sophisticated, often having not only their own design teams but also their own construction crews. The government of developing countries can influence the price and availability of certain materials and thus the type and technical sophistication of construction by owning and operating major construction materials manufacturing plants (e.g., cement, steel, and glass). By providing preferential treatment to a particular sector of the construction industry, the government, in its roles as financier and policy-maker, also can substantially affect the distribution of available manpower in the industry and increase the tendency for technological innovations in that area. Finally, as a regulator, the government can establish building codes and related regulations placing external constraints on the industry.

The architects, engineers, and consultants form the professional sector of the industry. The architect's major role is in the development of commercial, institutional, apartment, and public buildings, the engineer's in that of industrial buildings, the structural, electrical, and mechanical aspects of all other buildings, and heavy and highway construction. The major activities of the professionals encompass the following: (1) ascertaining the needs and desires of the client, (2) developing a satisfactory design, (3) drawing up plans and specifications, (4) aiding in the selection of the contractor, and (5) overseeing the project by making certain work is performed in accordance with the construction contract documents while serving as a liaison between the owner and contractor. The professional's legal tie to the owner is generally a negotiated contract whereby the professional is selected on the basis of his qualifications and the price negotiated, although price sometimes plays a role in selection.

The professional group is generally the least advanced sector of the construction industry in developing countries. Much construction is carried out without a professional designer per se, and the public sector is often the principal or even sole employer of such professionals. Developing nations thus tend to rely rather heavily on aid from developed countries in this area. Designs by expatriate professionals, however, are often poorly suited to locally available labor, materials, equipment, and construction methods. Unfortunately, this is not a problem unique to developing countries; a similar situation exists in the developed countries due to the separation of design and production in construction. This lack of collaboration between the designer and contractor further slows the introduction of new materials, processes, and equipment and does little to minimize the cost of the facility. It is becoming more common, however, for the contractor to be consulted before the design is completed as designers and owners begin to realize what he can contribute. Furthermore, design-construct firms, design-construct or turnkey contracts, and construction teams formed during the initial stages of a project and composed of the owner, designer, and construction manager (someone who has both management expertise and construction know-how) are beginning to be used and hold some limited promise for helping to alleviate the problem in both developing and developed countries. What developing countries need in addition, of course, is to cultivate local professional expertise.

The contractor is primarily a resource manager, where the resources include men, materials, equipment, money, and time. The contractor sector then, whose prime responsibility is the assembly operation, is made up of general contractors, speciality contractors (subcontractors), construction workers, and material and equipment manufacturers and suppliers. The general contractor must be skilled both in the techniques of construction and in the management of construction operations. He is responsible for the planning, coordination, and supervision of the entire production process and for the completed facility's adherence to the projected plans and specifications. The general contractor, who is usually tied to the owner by means of a competitively bid contract, generally delegates the more specialized activities to subcontractors. The amount of work subcontracted varies among countries and projects although it is generally fairly high in the developed countries. Subcontractors are usually tied to the general contractor through a competitively bid contract, although systems of separate and several contracts do exist where all parties contract directly with the owner and there is no main contractor.

The practice of competitive bidding for construction contracts is widespread, particularly in the public sector, in both developed and developing countries (see Table A2.5). A very negative feature of this procedure, especially in developing countries, is that it not only forces the separation of design and construction but also essentially forces the contractor to choose a technology dictated by design rather than one suitable to local conditions. Moreover, competitive bidding has really only one criterion, price, and quality and time should also be important to the owner. Competitive bidding puts the contractor in an adversary relationship with the owner and designer; it makes continuous working relationships among participants essentially impossible; and it does little to encourage a contractor to build up a favorable reputation, for on the next job he will be selected only if he has the lowest bid. Some of the approaches mentioned above for alleviating the problem of separation of design and construction may be executed with competitively bid construction contracts, while others rely on negotiated ones.

Negotiated contracts are frequent in the private sector and are generally used in all countries for maintenance and repair work which cannot be prescribed and quantified with sufficient precision in advance, and for highly specialized operations where there is no competition. The difficulty with negotiated contracts in the public sector lies in safeguarding the public interest and preventing favoritism and corruption. With few exceptions, the developing countries have adopted the most traditional and often inhibiting contractual procedures which unfortunately presuppose a level of administrative and technical competence generally lacking in these nations.

In all countries the basic unit of the construction industry is the individual firm. In many developed market economies the industry consists of an agglomeration of generally small and specialized firms which serve a local market, lack vertical integration, rely on low capitalization, do little mass production, exhibit little in the way of economies of scale, and are transient. There is, however, some trend away from these characteristics with the increasing role of the corporate form of organization and the formation of conglomerates in the industry. In fact, the larger and less specialized firms do a very disproportionate share of the work, employ a very disproportionate share of the labor force, and are most commonly international in their operations. The data given in Tables A2.6 through A2.9 and Figures A2.2 and A2.3 for various developed countries substantiate several of these observations about the construction industry.

While few statistics exist on the exact nature of construction firms in developing market economies, the general trend seems to be toward the fragmentation apparent in the developed market economies. In most developing countries a fairly sizeable portion of construction, the traditional sector concerned with small projects in rural areas, is carried out in the non-monetary category of the economy, and thus little is known about it. The remaining construction activity, largely infrastructural projects and urban development, is executed by means which vary with the level of development.

Five stages can usefully be outlined in the development of this part of the construction industry: (1) foreign firms do most of the work, since they are the only ones with enough expertise to handle larger projects; (2) local subcontractors develop; (3) small local contractors execute the smaller projects; (4) local contractors take over most local work, regardless of magnitude, joint venturing with foreign firms as necessary; and (5) local contractors go abroad. The five-stage development process has already occurred in many Latin countries, is now happening in the Far East, and will soon take place in Africa (2).

It is natural that the developing construction industries should follow the techniques and organizational methods employed in industrialized countries, but that this is best for the developing countries is open to serious question. Some of the sparse statistics on the construction industry in developing countries of particular interest to this paper are given in Tables A2.10 through A2.14.

The assembly phase of the construction process can itself be broken down into several steps, each of which involves a rather unique mix of labor, equipment, and materials, and has a certain amount of technological flexibility. For example, in building, the foundation and grading phase may be a highly mechanized, capital-intensive process requiring a few operating engineers and other fairly easily-trained semi-skilled labor; or, at the other extreme, it may be a fully manual, labor-intensive activity requiring large amounts of minimally-trained unskilled labor. The same is true with various aspects of heavy and highway construction. Electrical and mechanical work, on the other hand, although always highly labor-intensive, requires highly skilled labor obtainable only through extensive training. The planning and design phases play an important part in determining the technological nature of the assembly operation. For example, a design requiring a single large dam can be constructed only in a highly capital-intensive manner, whereas one requiring a series of smaller dams might better employ more labor-intensive procedures.

The fraction of cost allocated to each specialized process in the assembly phase naturally varies from project to project, with a typical breakdown for building cost in the U.S. given in Table 2.9a and breakdowns for housebuilding in various African countries in Table 2.9b. The allocation of costs in these two regions seems reasonably alike, except African countries tend to invest less in electrical and sanitary work than does the U.S. possibly because of differences in definition, facilities provided, and unit costs. This assembly process typically consumes up to 90 percent of total initial investment and constitutes the lengthiest phase of the construction process.

The major components of cost in the assembly operation are labor, materials, equipment, and overhead and profit, the mix of which varies not only among the steps of the assembly process but also among the various types of construction. The allocation of these costs among different types of construction in the U.S. given in Table 2.10a indicates that the distribution of costs is quite similar for residential and nonresidential building with materials a little higher in nonresidential, overhead and profit a little higher in residential, and equipment very small in both. In public works construction, labor's share is close to that in all building construction and overhead and profit's share is close to that in nonresidential building, but the contribution of materials is much less and of equipment much more than in building construction. Breakdowns of construction costs in Korea and housebuilding

Table 2.9a: Typical breakdown of total construction cost by elements of the building in the U.S. (source: ref. 13).

Process	Percentage of Cost
Foundation and grading	5-15
Erection and framing	25-55
Electrical and mechanical work	20-35
Finishing	15-35

Table 2.9b: Breakdown of cost by elements of building for housing in Africa[a] (percentages) (source: ref. 20)

Country	Structural			Finishes and equipment			
	Sub-structure	Super-structure	Subtotal	Doors and windows	Finishes	Sanitary and electrical installations	Subtotal
<u>Single story construction</u>:							
Ethiopia	5.0	42.8	47.8	14.5	27.7	10.0	52.2
Madagascar	10.0	56.4	66.4	6.8	16.4	10.4	33.6
Mauritania	6.5	43.0	49.5	8.3	28.0	14.2	50.5
Mauritius	11.8	68.0	79.8	12.5	7.7	-	20.2
Senegal	6.0	43.0	49.0	11.9	26.0	13.1	51.0
Upper Volta	7.8	45.1	52.9	11.8	19.0	16.3	47.1
<u>Multi-story construction</u>:							
Ghana	14.0	39.5	53.5	11.2	25.8	9.5	46.5
Kenya	11.1	52.1	63.2	10.5	19.6	6.7	36.8
Libya	10.3	39.5	49.8	12.6	25.5	12.1	50.2
UAR	10.2	41.2	51.4	17.3	19.2	12.1	48.6

[a]Source (copyright 1965) gives no date.

Table 2.10a: Percentage distribution of construction costs, by type of construction, in the U.S. (source: ref. 1,32)

Type of construction and year		On-site wages	Materials	Equipment	Overhead and profit[a]
Federally aided highways					
	1971[b]	25.9	45.1	-[c]	29.0[c]
	1970	25.6	45.0	-[c]	29.4[c]
	1967	24.8	47.8	-[c]	27.4[c]
	1964	26.0	50.3	11.1	12.6
	1961	24.7	52.6	11.7	11.0
	1958	23.9	50.6	12.0	13.5
Elementary & secondary schools					
	1964-65	25.8	54.2	1.0	19.0
	1959	26.7	54.1	1.4	17.8
Hospitals					
	1965-66	29.6	50.4	1.3	18.7
	1959-60	28.2	53.2	1.2	17.4
Public housing					
	1968	32.4	43.4[d]	-[d]	24.2
	1959-60	35.5	45.0	2.5	17.0
Private single-family housing[e]					
	1969	20.4	43.4	0.9	35.3
	1962	22.1	47.2	1.0	29.7
Sewer works					
lines	1962-63	24.3	44.5	11.2	20.0
plants	1962-63	26.6	49.2	8.2	16.0
Civil works (Corps. of Eng.)					
land operations	1959-60	26.0	35.0	19.3	19.7
dredging	1959-60	32.3	17.3	24.9	25.5
Federal office buildings					
	1959	29.0	51.4	1.9	17.7

(continued)

(Table 2.10a continued)

Type of construction and year	On-site wages	Materials	Equipment	Overhead and profit[a]
Nursing homes				
1965-66	25.6	54.9[d]	-[d]	19.5
College housing				
1960-61	29.3	52.6	1.6	16.5

[a]Includes off-site wages, fringes, construction financing costs, inventory, and other overhead and administrative expenses as well as profits.

[b]Preliminary, from ref.

[c]Equipment included in overhead and profit.

[d]Equipment included in materials.

[e]Construction costs include selling expenses in addition to construction contract costs (selling expenses were 2.9 percent in 1969).

costs in various African countries are given in Tables 2.10b and 2.10c, respectively. In Korea heavy concentration on public works construction (nearly half of all construction) partly accounts for the low share of materials and high share of overhead and profit (assuming equipment is included in the latter category). Further, the local industry appears to be quite well developed, and thus rather labor-intensive methods and local materials are likely used. As for Africa, much work is still done by expatriates who may use the relatively cheap local labor (accounting for the low labor costs) or who may have to import labor (accounting for the high labor costs). Materials are largely imported and thus expensive. Overhead and profit, on the other hand, are relatively low in some cases because certain African projects may be carried out by direct labor with no recorded profit.

While the contribution of labor to construction cost is simliar in various types of construction, the types of labor needed are quite different. Table 2.11 which gives breakdowns by trade of construction workers in various developed countries shows that skilled workers compose about 50 percent of the total labor force. Table 2.12 then gives breakdowns of the man-hours of different workers required for various types of construction in the U.S. The total man-hours required for each of the four types of construction are not too different, nor are the man-hours for other industries and for the construction industry as a whole (although federal office buildings are somewhat higher); but there are significant differences in the breakdowns of man-hours required within the construction industry, particularly on the site. The requirement for construction trades in building construction is nearly twice that in public works construction; about half of that in public works is for operating engi-

Table 2.10b: Cost components of construction contracts completed in Korea (source: ref. 9)

Cost component	1966	1967	1968	1969	1970
Completed contracts (million won)	41,441	64,112	116,918	169,723	185,318
(percent)	(100.0)	(100.0)	(100.0)	(100.0)	(100.0)
Materials (million won)	17,920	27,813	46,013	64,214	73,827
(percent)	(43.2)	(43.4)	(39.4)	(37.8)	(39.8)
Wages (million won)	11,864	18,052	32,147	46,241	52,075
(percent)	(28.6)	(28.2)	(27.5)	(27.2)	(28.1)
Subcontracts (million won)	1,739	2,559	6,166	10,045	12,238
(percent)	(4.2)	(4.0)	(5.3)	(5.9)	(6.6)
Overhead (million won)	4,444	7,172	17,128	25,172	21,512
(percent)	(10.7)	(11.1)	(14.6)	(14.8)	(11.6)
Gross profits (million won)	5,474	8,515	15,464	24,050	25,666
(percent)	(13.2)	(13.3)	(13.2)	(14.2)	(13.8)

Note: Details may not add to totals due to rounding.

Table 2.10c: Breakdown of cost of housebuilding by elements of cost for Africa[a] (percentages) (source: ref. 20)

Country	Materials	On-site labor	Overhead and profit
Ethiopia	63	20	17
Kenya	70	25	5
Ghana	47	39	14
Libya	48	32	20
Madagascar	66	25	9
Mauritania	52	36	12
Senegal	58	24	18
UAR	60	25	15
Upper Volta	42	31	27

[a]Source (copyright 1965) lists no date.

Table 2.11: Breakdown by trade of construction workers in various developed countries (as percentage of total) (source: ref. 27)

Occupation	U.S. (1960)	Germany (Fed. Rep.) (1963)	Sweden (1960)	Netherlands (1962)	Czechoslovakia (1962)
Skilled workers	57.5	44.1	53.4	-	47.7
Masons	5.1	20.7	-	16.8	18.1
Carpenters	19.5	7.8	-	20.7	6.0
Concretors	0.9	1.6	-	6.4	5.3
Electricians	8.0	-	6.5	-	-
Operators of earth-moving machines	4.7	-	-	-	-
Painters	8.8	6.7	9.1	5.5	7.2
Plumbers	7.3	-	8.5	-	4.4
Crane operators	3.0	7.0	-	-	-
Unskilled laborers	17.4	35.3	23.1	-	29.4
Others	25.1	20.6	23.5	20.0	22.9

Table 2.12: Distribution of man-hours per thousand dollars of contract cost for various types of construction in the U.S., by industry and occupation (source: ref. 15, 31, 32, 33)

Industry and occupation	Private single family housing[a] (1962)	Federal office building[b] (1959-1960)	Sewer works[c] (1962-1963)	Civil works-land operations[c] (1959-1960)
Total man-hours	202	227	221.9	208
Construction industry	84	107	91.7	89
On-site	72	97	84.5	85
Supervisory, professional, technical and clerical	2	5.8	9.5	9.3
Construction trades	53	58.4	30.5	33.7
Operating engineers	1	2.3	14.7	20.4
Carpenters	25	12.2	6.5	5.4
Electricians	2	8.8	1.3	0.1
Plumbers	4	8.5	2.1	0.1
Bricklayers	4	5.0	1.4	-
Iron workers	-	3.3	1.6	2.6
Painters	7	2.0	.6	0.1
Plasterers and lathers	1	3.8	-	-
Cement finishers	3	2.0	1.1	1.0
Other trades	6	10.5	1.2	4.0
Semi-skilled[e]	-	1.3	6.3	20.5
Unskilled[f]	17	31.5	38.1	21.3
Off-site	12	10	7.2	4

(continued)

(Table 2.12 continued)

Industry and occupation	Private single family housing[a] (1962)	Federal office building[b] (1959-1960)	Sewer works[c] (1962-1963)	Civil works-land operations[d] (1959-1960)
Other industries	118	120	130.2	119
Manufacturing	61	79	72.6	53
Wholesale trade, transportation, services	31	29	41.2	47
Mining, all others	26	12	16.3	19

Note: Detail may not add to totals due to rounding.

[a] Reference 32.

[b] Reference 15.

[c] Includes sewer lines and plants, ref. 33.

[d] Includes levees, dams, pile dikes, bank stabilization, local flood protection, and miscellaneous other projects, ref. 31.

[e] Includes truck drivers, oilers and greasers, power tool operators, and powdermen and blasters.

[f] Includes laborers, helpers and tenders, pipelayers, deck hands, watchmen, and flagmen.

neers, who are easier to train than are the more highly skilled trades required for building construction. Moreover, the use of semi-skilled and unskilled labor in public works construction is more than twice that in single-family housing and nearly one and a half times that in federal office buildings. It should also be noted that as the semi-skilled and unskilled man-hours rise so do the supervisory, professional, technical, and clerical man-hours. While these proportions may not be exactly the same for developing countries, the trends may be expected to be similar. For many developing countries, therefore, a major difficulty in building construction appears to be a shortage of skilled labor; in public works construction, the problem seems to be a shortage of supervisory personnel and, to a lesser degree, a shortage of skilled labor.

The time trends of the allocations of component costs for various types of construction in the U.S. in Table 2.10a show that labor's and equipment's shares are generally steady, while that of materials is declining and that of overhead and profit rising. The time trends of man-hours required for construction of highways and single-family housing in the U.S. in Tables 2.13a and 2.13b, respectively, show that man-hours are declining. It thus seems that the decline in man-hours has been offset by increasing wages.

In the developed countries, increases in the cost of labor relative to other inputs (see Figure 2.4) have led contractors to search for labor substitutes, perhaps through the use of more productive equipment or a more capital-intensive method of construction which reduces on-site labor requirements. For example, trends toward industrialized housing and prefabricated components in building, and the substitution of very high land fills for bridges in road construction serve to re-

Table 2.13a: Distribution of man-hours per thousand dollars of contract cost for new federally aided highway construction in the U.S., in 1967 dollars, by industry and occupation, for selected years(source: ref. 1)

Industry and occupation	1958	1961	1964	1967	1970[a]
Total man-hours	221.5	200.6	180.9	165.8	157.4
Construction indust	100.5	89.4	80.4	78.8	74.6
On-site	91.1	81.0	72.4	70.1	66.2
Executive, administrative, supervisory[b]	9.5	8.3	7.0	na	4.1
Skilled[c]	34.8	31.7	31.8	na	31.1
Semi-skilled[d]	19.9	16.8	14.8	na	31.0
Unskilled[e]	27.0	24.2	18.7	na	
Off-site	9.5	8.4	8.1	8.7	8.4
Other industries	120.9	111.3	100.5	87.0	82.8
Manufacturing	61.9	58.6	48.9	48.4	46.1
Wholesale trade, transportation, services	36.9	33.0	31.9	27.9	26.7
Mining, all others	22.2	19.6	19.7	10.6	10.1

Note: Detail may not add to totals due to rounding.

[a]Preliminary.

[b]Includes technical and clerical personnel.

[c]Includes heavy equip-ment operators, skilled craftsmen of journeyman grade, and working foremen.

[d]Includes apprentices, on-the-job trainees, and operators of trucks larger than 1.5 tons and tractors with more than 20 horsepower.

[e]Includes helpers, tenders, laborers, and operators of trucks of 1.5 tons or less and tractors of 20 horsepower or less.

Table 2.13b: Distribution of man-hours for construction of new private single-family housing in the U.S., by industry and occupation (source: ref. 32)

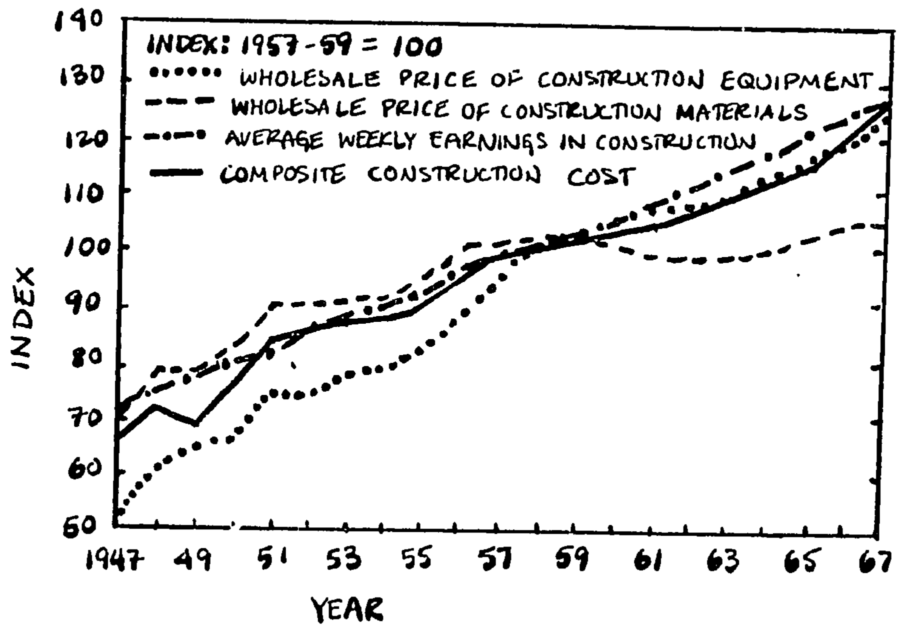
Industry and occupation	Man-hours per 100 square feet		Man-hours per $1000 of construction cost	
	1962	1969	1962	1969
Total man-hours	238	217	202	137
Construction industry	99	98	84	62
On-site	85	82	72	52
Supervisory, professional, technical, clerical	3	2	2	1
Skilled[a]	62	58	53	36
Unskilled[b]	20	23	17	14
Off-site	14	16	12	10
Other industries	139	119	118	75
Manufacturing	72	65	61	41
Wholesale trade, transportation, services	36	32	31	20
Mining, all others	31	22	26	14

Note: Detail may not add to totals due to rounding.

[a]Includes all common skilled trades.

[b]Includes laborers, helpers, and tenders.

Figure 2.4: Price indexes of factors of construction in the U.S. (source: ref. 4)



duce labor requirements. Referring to Table 2.13, however, it is important to note that the majority of the savings in man-hours has been in the industries other than construction. Within the construction industry, for highway construction, the major saving has been in unskilled and semi-skilled man-hours, although the opposite has been true in single-family housing construction. The implication of this is that reduction of construction man-hours is perhaps not particularly feasible. In any case, it seems likely that the techniques currently being developed in the industrialized countries may not be especially suitable for use in developing countries due to their incompatibility with local conditions. Rather, some of the older techniques relying less on capital-intensive methods and more on labor, particularly unskilled and semi-skilled labor, might be more appropriate.

CHAPTER 3

ISSUES IN THE DEVELOPMENT OF THE CONSTRUCTION INDUSTRY IN EMERGING NATIONS

In considering the development of the construction industry in emerging nations, this chapter begins by determining what construction capabilities are available and what are needed. Means of alleviating these needs are considered and evaluated.

Construction normally falls into one of two general categories--(1) repetitious and routine activities for fulfilling volume needs, such as highways and bridges, manufacturing, commercial and institutional buildings, and single and multi-family housing; and (2) specialized and sophisticated activities for fulfilling one or two-time needs, such as huge dams and power plants. This chapter focuses primarily upon the first group of activities, for it is here that an indigenous construction industry should first develop. The second group of activities, requiring highly specialized skills and sophisticated technology, will continue to be performed by multi-national construction firms, although by their work with local people and firms some of this expertise may be passed on to the developing indigenous industry. Consideration of the role of multi-nationals in this area is treated in Chapter 4.

The development of construction capabilities is discussed here in terms of the four major stages of the construction process—planning, design, construction, and maintenance. Finally, the environment within which the industry is to develop is considered.

3.1 Planning

There are two levels of planning associated with the construction industry; one is concerned with national development plans, the other with planning at the project level. This section of the report deals with planning associated with a particular project. The client sector is the only participant involved in this phase, and if the owner is, for example, a corporation or a public agency, it probably has its own in-house planning staff. The manpower and capital requirements for this stage are thus rather small, but the required manpower must have certain highly technical capabilities.

Planning of facility construction involves assessment of the need for a new facility, study of user requirements, determination of budgetary constraints, feasibility and economic analyses, site evaluation and selection, and so forth. The level of sophistication, difficulty, and completeness of such analyses varies with project type, size, and owners. This planning should review the supply of and demand for certain construction capabilities in the form of available designers, contractors, capital, labor, materials, and equipemnt. Moreover, such project evaluation should consider various alternative solutions to user needs, appropriate factor prices, associated indirect and secondary effects, social and political aspects, and compatibility with national priorities such as employment creation, income re-distribution, and output generation. Such considerations are also important in the selection of the design, technology, and contractor. Although standard planning analyses are generally performed in developed countries and to some extent in developing countries, inclusion of the above additional considerations is relatively rare in both developed and developing countries, except in a few public works projects.

Such planning analyses require the development of a rather extensive information base on the construction industry, on particular types of projects, and on various socio-economic aspects of the country. Moreover, development of local capabilities for doing planning analyses is of importance, since foreign consultants have thus far largely been relied upon for such analyses.

The use of the computer may help to substantially increase the capability and productivity of local planners. New computerized techniques of information processing have, for example, allowed the industry in both developed and developing countries to apply the principles of systems engineering in the evaluation of alternative strategies for large-scale projects such as regional water distribution and transportation network systems; and the further use of computers in this area by local planners certainly warrants consideration. Nevertheless, some local skills still need to be developed, and it will probably be necessary for the developing countries to continue to rely for a while on foreign consultants, although they may be somewhat insensitive to local conditions. In addition, extensive research into appropriate analysis techniques and computer applications is necessary.

Financing* is an important part of the planning phase because of the costly nature of constructed facilities. There are two basic types of capital involved in construction: (1) the owner's funds used to fi-

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*It should be noted that the discussion and associated data on financing do not reflect the recent developments in the oil-producing countries.

nance the project during the period between its inception and the time it begins to yield its social and economic benefits, and (2) the contractor's capital which bridges the gaps between payments by the owner and purchases of materials and equipment. The first type of capital is of major concern here; the second is discussed in Section 3.32.

The interest paid on capital of the first sort may add from 5 to 10 percent to the capital cost of many private building projects depending upon prevailing interest rates, financial arrangements, and fiscal conventions (48). For example, debt service, principal and interest on the mortgage, and FHA insurance premiums made up 58.7 percent of the ownership expense of new FHA houses in the U.S. in 1966 (62). When the government is the client, however, these matters are often masked by the public budgetary conventions and the fact that market interest rates are seldom charged during the period between a project's inception and the time it begins to yield economic returns.

The details of the financing process vary, of course, depending upon the type, size, and location of the construction project, the participants, economic conditions, and so forth. For example, in the U.S. in the case of private single-family homes, financing is generally in the form of construction loans and mortgages; in the case of private nonresidential building, financing may be by means of internal or external funds as well as by loans secured by the property. In the case of public construction, financing is generally by means of municipal or federal bonds, current revenues, or federal aid. In the U.S. and other industrialized countries financing is usually through domestic sources, while in the developing countries both domestic and foreign funds are used. In Africa, for example, as in many other developing areas, a large part of private investment is financed by loans granted by various financial institutions, and only a small part is financed by personal savings and foreign funds; public sector projects, on the other hand, are often heavily dependent or foreign funds for financing (41).

Construction products require high capital investment, something which is in scarce supply in most developing countries. In fact, construction makes up roughly 50 to 60 percent of gross capital formation and 55 to 65 percent of gross fixed capital formation in both developing and developed countries; the figures, however, tend to fluctuate considerably depending upon the country's particular area of interest (see Table A3.1a). The shares of gross capital formation and of gross fixed capital formation in GDP, however, are generally less in the developing countries than in the developed ones due to the shortage of capital, although their growth rates are generally higher in developing areas than in developed ones due to their importance in economic development (see Table A3.1). Even so, gross domestic savings in developing countries are not generally sufficient to finance the limited amount of gross domestic capital formation, and thus some foreign funds are also generally necessary (see Table A3.2). Foreign sources of finance, moreover, are also important in terms of supplementing the available foreign exchange reserves and thus increasing the import capacity of developing countries.

The domestic resources available for capital formation, in particular in the form of constructed facilities, can in the final analysis come only from national savings, comprised of household, corporate, and government savings (see Table A3.3). Mobilization of national savings in the direction of capital formation depends upon a variety of factors, including: (1) attitude of people toward immediate versus future consumption; (2) availability of appropriate institutional arrangements and knowledge about them; (3) activities of central banks, in particular in forming the monetary policy (Table A3.4 suggests interest rates in developing countries fluctuate much more than in developed ones); (4) willingness of corporations to plough-back profits or invest otherwise so as to increase capital formation; and (5) fiscal and taxation policy (42). Efforts to influence these factors so as to increase and channel savings in the appropriate direction for capital formation must be undertaken in developing areas where the level of national income is still low.

Households may directly contribute their savings to capital formation through investment in housing or other real estate. It has also been a common practice in developing countries to save privately, often by hoarding cash, rather than to save through well organized and managed institutions which can effectively utilize the money. Some of the appropriate institutions into which household savings might be channeled include: commercial banks, savings banks, life insurance companies, pension funds, provident trusts, investment trusts, mutual funds, and the stock exchange.

Corporate savings might be directly used to finance the expansion or improvement of existing industries or the establishment of new ones, or may alternatively be channeled into some of the institutions in the capital market mentioned above. Such funds may come from internal sources such as retained earnings or undistributed profits, or from external sources such as the sale of corporate bonds.

Public savings are the third and final source of national savings. In developing countries, the government generally has the responsibility of providing the general infrastructure and institutional facilities, the domestic financing of which will be through public savings. The sources of these savings include: (1) budget surpluses which may be derived from tax revenue and other receipts less expenditures, with tax revenue being the main source of income; (2) government domestic borrowing from the capital market through treasury bills and government bonds; and (3) profits generated by government enterprises.

Two other institutions, industrial development banks or industrial development finance companies, and industrial development corporations, warrant some comment with regard to domestic financing of industrial development. The first are financial institutions which speicalize in industrial development and may be publicly or privately owned. They provide financial assistance to select industrial investment projects, usually accompanied by technical assistance, and often help to channel capital and expert technological knowledge from abroad to domestic projects. Industrial development corporations, on the other hand, are wholly-owned government corporations established to set up industries entirely through their own resources. They generally execute and operate the industries for some time, and once an industry has demonstrated profitable operations, they disinvest in favor of private enterprise.

The flow of foreign resources into developing countries may be in the form of official aid either channeled directly from the developed to the developing country (i.e., bilateral aid) or channeled through a multilateral institution, or in the form of private aid (See Tables 3.1 and A3.5). It is of interest to note that although the overall trend of aid to developing countries is growing, the average official share is declining while the private share is climbing. The relative distri-

Table 3.1: Flow of resources to the developing countries and multilateral agencies from various developed market economies, 1961-1969 (source: ref. 39)

Country and period		Average annual total transfers (millions of dollars)	Percentage distribution of total net transfers of resources						
			Official				Private		
			Total	Bilateral		To multilateral agencies	Total	Direct and portfolio investment[a]	Export credit[b]
				Loans	Grants				
Austria	1961-1963	7	-53	-3	12	-62	153	34	119
	1964-1966	36	72	34	8	31	28	4	24
	1967-1969	56	52	15	6	32	48	3	45
Denmark	1961-1963	11	-113	13	-21	-104	213	-27	240
	1964-1966	19	65	7	21	37	35	-4	39
	1967-1969	82	61	12	14	35	39	4	36
France	1961-1963	1,302	72	9	57	6	28	23	6
	1964-1966	1,258	62	9	50	3	38	27	12
	1967-1969	1,491	59	7	47	4	41	26	16
Japan	1961-1963	257	54	40	29	-15	46	31	15
	1964-1966	416	76	56	21	-	24	17	7
	1967-1969	958	67	52	14	1	33	11	23
Norway	1961-1963	12	56	-	63	-7	44	18	25
	1964-1966	22	53	-	19	34	47	8	39
	1967-1969	56	48	1	16	31	53	9	44
Portugal	1961-1963	45	100	83	11	6	-	-	-
	1964-1966	37	71	67	23	-18	29	29	-
	1967-1969	65	66	66	16	-17	34	34	-

(continued)

(Table 3.1 continued)

Country and period		Average annual total transfers (millions of dollars)	Percentage distribution of total net transfers of resources						
			Official				Private		
			Total	Bilateral		To multi-lateral agencies	Total	Direct and portfolio investment[a]	Export credit[b]
				Loans	Grants				
United Kingdom	1961-1963	721	57	24	27	6	43	34	9
	1964-1966	894	53	23	24	6	47	36	11
	1967-1969	836	52	19	26	8	48	29	19
United States	1961-1963	4,066	80	17	58	4	22	22	1
	1964-1966	4,781	70	18	49	3	30	29	1
	1967-1969	5,060	68	27	35	6	32	31	1
Average or total[c]	1961-1963	8,055	69	17	46	6	31	25	6
	1964-1966	9,338	64	19	40	5	36	28	8
	1967-1969	11,820	58	22	29	7	42	30	12

[a]Including funds invested in loan obligations of the international development aid institutions.

[b]Including the non-guaranteed portion of insured credit.

[c]The source does not make it clear whether this is for the Development Assistance Committee (DAC) countries only (i.e., Australia, Austria, Belgium, Canada, Denmark, France, Federal Republic of Germany, Italy, Japan, Netherlands, Norway, Portugal, Sweden, Switzerland, United Kingdom, and United States) or for all developed market economies (i.e., DAC countries plus Finland, Iceland, Ireland, Luxembourg, New Zealand, and South Africa). It appears to be only for the DAC countries, but in any case this can serve as an indicator for all developed market economies since the non DAC countries' contribution to this transfer of resources is small and likely would not alter the distribution much if at all (e.g., their average annual transfers for the period 1967-1969 were only about 31 million dollars [55]).

butions between official and private, and between bilateral loans and grants are very different for the various developed countries shown. Table 3.2 shows considerable variation among some of the contributing developed market economies in their ratios of the net outflow of resources to GNP. It is particularly noteworthy that the U.S. is such a large contributor, giving about 50 percent of the total foreign aid, but its share in recent years has been declining (55), and its ratio of net outflow of resources to GNP is below the average. With regard to financial terms of official commitments, the U.S. terms in general appear to be about average or somewhat more favorable than the average (see Table A3.6).

The data in Tables 3.3 and A3.7 give an indication of the distribution of official and private aid resources among the developing regions of the world, particularly the aid received by the five developing countries of interest in this report. It is not surprising that, due to the relative levels of development and corresponding willingness of private investors to enter the picture, private aid to Latin America on a per capita basis is much higher than to Africa and Asia. In total amounts, however, Asia actually receives more official aid than do Africa and Latin America combined, although it receives less than each on a per capita basis.

There thus appears to be much data available on the sources, destinations, and financial terms of the flow of foreign resources into developing countries, but there is a lack of data on the purposes which these funds serve. Table 3.4 gives some indication by purpose of the distribution of official bilateral and multilateral commitments. Fixed capital formation, of which construction accounts for some 55 to 65

Table 3.2: Net outflow of resources compared to gross national product for some of the developed market economies, 1961-1969 (source: ref. 31,39)

Country	Per capita GNP[a] in 1968 (dollars)	Ratio of net outflow of resources to GNP: Average overall ratio (percent)			Average ratio of official transfers (percent)			Average annual net outflow per capita[b], 1961-68 (dollars)	Per capita total official and private flows in 1968 (dollars)
		1961-63	1964-66	1967-69	1961-63	1964-66	1967-69		
Austria	1550	0.07	0.38	0.48	-0.03	0.27	0.25	4.0	10.0
Denmark	2540	0.16	0.19	0.60	0.07	0.13	0.32	5.5	15.1
France	2510	1.81	1.29	1.13	1.30	0.80	0.68	26.7	29.5
Japan	1410	0.43	0.46	0.67	0.24	0.36	0.44	4.7	10.4
Norway	2360	0.18	0.31	0.60	0.11	0.14	0.29	6.4	15.1
Portugal	540	1.56	1.01	1.28	1.56	0.80	0.85	4.8	5.1
United Kingdom	1850	0.90	0.89	0.78	0.51	0.48	0.40	14.6	13.8
United States	4380	0.72	0.68	0.59	0.56	0.48	0.39	24.1	28.9
Total or average[c]	2770	0.77	0.70	0.70	0.54	0.45	0.41	15.8	21.0

[a]At market prices.

[b]Relative to mid-1965 population.

[c]This for per capital GNP in 1968 and per capital total official and private flows in 1968 is for DAC countries only (31). This for the other columns appears to be for all developed market economies, though the source (39) does not really make it clear whether it is for all developed market economies or only DAC countries.

Table 3.3a: Total official bilateral and multilateral net flows to various regions and developing countries, 1960-1971 (source: ref. 51,55)

Region or country and year		Average annual (million dollars)			Population (millions)	Per capita average annual (dollars)		
		Bilateral	Multilateral	Total		Bilateral	Multilateral	Total
Africa	1960-66	1500	169	1669	275.0	5.46	0.61	6.07
	1969-71	1376	425	1801	327.5	4.20	1.30	5.50
Ethiopia	1969-71	33.4	13.8	47.2	24.7	1.35	0.56	1.91
Kenya	1969-71	49.1	22.1	71.2	10.9	4.50	2.03	6.54
Latin America	1960-66	739	143	882	223.3	3.31	0.64	3.95
	1969-71	844	600	1444	278.8	3.03	2.15	5.18
Colombia	1969-71	105.6	71.9	177.5	20.4	5.18	3.52	8.68
Asia	1960-66	2469	232	2701	903.3	2.73	0.26	2.99
	1969-71	2915	470	3385	1064.5	2.74	0.44	3.18
Iran	1969-71	10.3	25.6	35.9	28.5	0.36	0.90	1.26
Korea	1969-71	300.4	30.1	330.5	31.1	9.66	0.97	10.61
Total[a]	1960-66	5420	599[b]	6019	1493.5	3.63	0.40	4.03
	1969-71	5895	1654	7549	1767.9	3.33	0.94	4.27

Note: Detail may not add to totals due to rounding.

[a]Includes Southern Europe, Oceania, and unallocated flows as well.

[b]Excluding figures for African and Asian development banks.

Table 3.3b: Per capita net receipts of foreign private capital[a] by various developing countries and regions, 1965-1968 (dollars) (source: ref. 51)

Region[b] or country	Average for 1965-1967	1968
Africa	1.7	1.3
Kenya	1.2	3.4
Ethiopia	0.7	1.0
Asia	0.5	0.8
Korea	4.7	15.4
Iran	3.5	2.2
Latin America	4.0	5.8
Colombia	3.7	3.3
World	1.3	1.9

[a]Net receipts of foreign private capital are defined as: foreign direct investment and loans received (net of repayments), including loans to local governments and private monetary institutions; and changes in other long-term liabilities (arising, for example, from transactions in existing bond issues of developing countries). The return flow of interest and profits is not deducted.

[b]The source does not make it clear whether the regional averages are just for the countries it lists in each region (Africa - 13 countries, Asia - 15 countries, and Latin America - 22 countries) or for all countries in the region. The world average in 1968 is noted as being for only 50 countries though.

Table 3.4: Official bilateral and multilateral commitments, by purpose, 1967-1968 (percentage) (source: ref. 51)

Purpose	Official bilateral	Official multilateral
Capital project assistance	30.04	83.09
Agriculture	2.38	16.82
Industry	11.04	13.39
Energy	4.23	19.34
Transport	6.35	22.57
Social infrastructure	3.47	9.82
Other	2.57	1.14
Technical assistance	19.27	15.37
Non-project assistance	23.10	1.52
Export credits	16.50	-
Other contributions	11.11	-
Total	100.00	100.00

Note: Detail may not add to totals due to rounding.

percent, probably predominantly falls under capital project assistance, and thus funds for the financing of construction might be expected to represent a fairly sizeable portion of capital project assistance. Construction also receives some aid in the form of technical assistance and export credits.

Some brief comments remain to be made about the various sources of foreign aid and their respective advantages and disadvantages. Official bilateral financial assistance may be allocated by, for example, the Agency for International Development (AID) in the U.S., Export Credits Guarantee Department of the Board of Trade or Commonwealth Development Corporation (CDC) in the U.K., Kreditanstalt für Wiederaufbau (KW) or Deutsche Gesellschaft für Wirtschaftliche Zusammenarbeit in the Federal Republic of Germany, or Caisse Centrale de Coopération Economique (CCCE) in France. The major advantage of bilateral assistance is that the financial provisions are generally more favorable than those of other sources in terms of longer repayment periods, lower interest rates, and, in some cases, repayment in local currency.

A problam with bilateral aid is that its allocation among developing countries tends to be determined by special political and economic ties. For example, the U.K. concentrates its assistance almost entirely on the Commonwealth countries, France largely on the African countries formerly administered by it, and the U.S. on Asia and the Far East and more recently Latin America. Korea particularly has received a high volume of per capita official bilateral aid (see Table 3.3a). More appropriate economic criteria for allocation of foreign assistance among developing countries need to be evolved. A second difficulty with official bilateral assistance is that it is often tied aid under which goods and services have to be purchased in the donor country. Some obvious disadvantages of this include the facts that it (1) may reduce competition among suppliers, (2) may make impossible the procurement of imports from the most economical sources, (3) may result in purchasing of goods and services which do not meet the recipient's requirements, (4) may encourage execution of low-priority projects for which suitable goods and services can be obtained in the aid-giving countries, and (5) may encourage importing goods and services instead of producing them locally. A partial solution to this problem was suggested by an UNCTAD group of experts in March 1966--when aid to a developing country is intended for the purchase of goods and services in the donor country, the beneficiary should be authorized to use such aid to make purchases in other developing countries as well (49).

A third problem in this area is the growing importance of official loans relative to official grants (see Tables 3.1 and A3.6a), which increases the debt-servicing burden of the loan-receiving countries and further aggravates the balance of payment problems of these countries. In addition, official aid is generally given for specified projects rather than on a program basis, which might be more readily coordinated with national development plans. The fifth and final difficulty with bilateral aid is that the various bilateral financing agencies have diverse procedures and there is often a long waiting period before aid is granted and mobilized. These last three difficulties are equally true of official multilateral assistance.

Some of the multilateral financing agencies include, for example, the International Bank for Reconstruction and Development (IBRD), International Financing Corporation (IFC), African Development Bank (ADB), Asian Development Bank, and European Development Fund (FED). The major advantage of multilateral over bilateral aid, aside from somewhat less pressure from political and economic ties, is, of course, the freedom to purchase goods and services in the world market. In fact, multilateral agencies often require international competitive bidding for contracts financed under these loans. Nevertheless, some of these agencies, such as the IBRD and IDA, generally finance only the foreign exchange costs of projects, which tends to encourage importing of goods and services rather than local production and may tend to encourage projects with large foreign exchange components even though they may not be of top priority in national development plans.

Private sources of foreign financial aid include private export credits, direct investment, and portfolio investment. Export credits are generally easy to obtain because the developed countries wish to export goods and services, but they are tied aid and are generally extended on a short- or medium-term basis at the commercial rates of interest in force in the lending country plus various banking and insurance charges. Annual repayment charges thus may be two or three times higher than those on bilateral credits (49), and private guaranteed export credits are generally repayable only in the currency of the lending country. Export credits may assume two forms--supplier and purchaser credit. Supplier credit, given to the supplier of goods and services, is most widespread and generally does not cover the entire cost of imported goods and services. Purchaser credit is generally given only for large projects but usually has a longer repayment period and may be somewhat cheaper since the purchaser can deal directly with the financing agency.

All industrialized countries operate export credit systems, but the numerous procedures vary. The centrally planned economies grant export credits that are like loan assistance, several developed market economies combine or modify export credits so that these will become a form of loan assistance, and in certain cases export credits from developed market economies may be granted by public bodies. Some of the major government-supported export associations in the developed countries are the Export-Import Bank (Eximbank) and its subsector the Foreign Credit Insurance Association (FCIA) in the U.S., Cie Francaise d'Assurances Pour le Commerce Exterieur (COFACE) in France, Hermes Kreditituersicherungs A. G. (HERMES) in Germany, and Export Credit Guarantee Department (ECGD) in the U.K. These export associations not only extend short-, medium-, and even long-term credit, but may also give guarantees of repayment for loans made by commercial banks. Moreover, regionalization of export credits (i.e., bringing several exporting countries together to provide export credits for a large project) is possible, and even some developing countries (e.g., India and Mexico) have adopted export credit systems.

As for foreign private investment, commercial banks, private corporations, and special private organizations may participate. For example, there is the Private Export Funding Company (PEFCO) which is helped by a group of fifty U.S. banks and corporations and the Overseas Private Investment Corporation (OPIC) in the U.S., the Latin American Economic Development Association, and the Private Investment Company for Asia (PICA). The three large regional development banks also can take action to stimulate foreign investments by associating such investments with projects they wish to promote. One of the commonest forms of private foreign investment in developing countries is the joint enterprise in which foreign and national capital are combined; technical, marketing, and personnel training agreements as well as financial agreements are usually included. There are a variety of factors which strongly influence private foreign investment, including availability of investment opportunities in the developing countries; economic and political stability of the developing countries; conditions relating to repatriation of capital and profits; arrangements for guarantees given to foreign capital at home or abroad; nature of legislation on monetary, fiscal, and tax policies at home and abroad; stability of the exchange rate; and availability of needed resources in the developing countries. Regional cooperation, international organizations, and developed countries, as well as individual developing countries, might assist in furthering private foreign investment through educational and promotional activities, while still attempting to consider the best interests of each participant.

3.2 Design

The design phase of the construction process, like the planning phase, requires fairly small manpower and capital resources, but again the needed manpower comes from a well-educated and experienced cadre of professionals (i.e., architects and engineers). As far as industrialized countries are concerned, averaged data for 1962 to 1966 show professional and technical personnel as 4.7 percent of construction employment in the U.S., which probably includes planners and consultants as well as architects and engineers (see Table 3.5a for U.S. figures and Table 3.5b for figures for England and Wales). Figures for Latin America for 1965, on the other hand, show professionals as only 0.9 percent of

Table 3.5a: Percentage distribution of employment in construction[a], in the U.S., averaged for 1962-1966 (source: ref. 5)

Occupation in the construction industry	Percentage of construction employment
Professional and technical personnel	4.7
Managers, officials, and proprietors	12.2
Clerical workers	5.2
Craftsmen, foremen, and kindred workers	50.7
Carpenters	14.5
Brickmasons, stonemasons, and tilesetters	3.7
Cement and concrete finishers	1.2
Electricians	4.0
Excavating, grading, and road-building machine operators	4.7
Painters	6.7
Plumbers and pipefitters	4.3
Plasterers	0.8
Roofers and slaters	1.1
Structural metalworkers	0.9
Tinsmiths, coppersmiths, and sheet metalworkers	1.0
Other	7.8
Operatives and kindred workers[b]	9.8
Service workers[c]	0.5
Laborers (including helpers)[d]	17.0

[a]Including employees of contractors, government force account, the self-employed, and unpaid family workers.

[b]Operatives are traditionally considered semi-skilled workers, including apprentices, asbestos workers, oilers and greasers, truck drivers, etc.

[c]Service workers include guards and watchmen, cleaning personnel, and others.

[d]Laborers include carpenters' helpers and other laborers.

Table 3.5b: Occupational class distribution in building and contracting and all industry, for England and Wales, 1951 (percent) (source: ref. 52)

Occupational Class	Building and contracting	All industry[a]
Higher professional	1.22	1.96
Lower professional	0.40	4.67
Employers, administrators, managers	3.88	9.95
Clerical workers	3.91	10.85
Foremen, inspectors, supervisors	3.78	2.69
Skilled workers	57.64	25.37
Semi-skilled workers	4.36	32.84
Unskilled workers	24.80	11.67

[a]Includes agriculture and fishing, mining, manufacturing, construction, utilities, distributive trades, transport and communications, finance, and government, professional, and other services.

employment in construction and technicians as 2.1 percent, although architects appear to be included in the other services category (see Table 3.5c). As for capital requirements, the American Institute of Architects suggests that architectural fees for a conventionally constructed apartment building, for example, should be 6 to 7 percent of total construction cost (11).

The magnitude of the shortage of professionals in construction in developing countries can only be hinted at by looking at figures on all professional, technical, and related workers' shares of the economically active population and of unemployment in various developing countries as compared with the U.S. As Table A3.8 shows, the shares of this class of workers in the U.S. are about four times those in the developing countries, with figures for Ethiopia and Kenya probably even smaller than those shown (a few figures for professionals in construction in Korea and Ethiopia are given in Tables A2.10c and A2.12b respectively). Of course, the specific needs of an individual nation cannot be determined without more data on the construction industry in that country. One report (12), for example, suggests that there are actually too many consulting engineering firms in Korea in relation to the volume of business, and that designs are often of poor quality, while in Ethiopia although there is a relatively large number of architects and engineers, many were trained abroad, lack practical experience, and tend to go into government jobs rather than into the industry itself. In most developing countries there thus appears to be a need for upgrading the existing professionals and their educational programs, and in many of the developing countries there is also a need to educate a greater number of local architects and engineers.

Table 3.5c: Occupational structure of the labor force for various industry sectors in Latin America, estimated for 1965 and projected for 1980 (percentage composition by vocational categories) (source: ref. 52)

Vocational Category	1965 Construction	1965 Manufacturing	1965 Agriculture and fishing	1965 Total[a]	1980 Construction	1980 Manufacturing	1980 Agriculture and fishing	1980 Total[a]
Professional and technical personnel	3.0	1.9	0.1	3.7	2.8	3.0	0.4	5.3
Professional	0.9	0.5	0.05	0.8	0.7	0.7	0.1	1.0
Technical	2.1	1.4	0.07	2.9	2.1	2.3	0.3	4.3
Administrative and managerial staff	1.9	2.9	0.2	3.0	1.5	2.5	0.3	3.1
Employees and salesmen	1.9	7.8	0.4	12.2	1.9	10.0	0.4	12.4
Operatives and artisan workers	92.1	86.3	98.2	67.4	92.6	83.0	97.9	67.1
Skilled	9.2	17.3	4.9	5.7	11.9	29.5	9.9	10.7
Semi-skilled	46.0	43.1	14.[illegible]	17.0	50.0	45.0	30.0	26.4
Unskilled	36.9	25.9	78.6	44.7	30.7	8.5	57.9	30.0
Services personnel	1.1	1.1	1.1	13.7	1.1	1.5	1.0	12.2
Total[b]	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

[a]In addition to the three industry sectors in the table, this includes mining and quarrying and basic and other services.

[b]Percentages are based on the following figures for total employment: 1965 - total 76,416,000, construction 2,969,000, manufacturing 10,546,000, and agriculture and fishing 35,221,000; 1980 - total 120,000,000, construction 7,200,000, manufacturing 20,000,000, and agriculture and fishing 49,300,000.

Many of the existing educational programs need some reorientation, particularly in the direction of teaching more practical concepts, increasing field experience and contact with industry, and lessening the distinct separation between the designer and contractor. The Colombian Fund for Scientific Research (COLCIENCIAS) in Colombia, for example, has developed a "Government-University-Industry" program directed toward the first two of these ends (32). The continued use of expatriates, as seems to have been done in the past in Iran (12), is a possibility for help in increasing training capabilities, but this may not be too promising because of their insensitivity to local conditions and because of a professionals' need for in-class as well as on-the-job training. Such an approach might be more suitable for draftsmen and other technicians. The accepted traditional training of local professionals in universities in the industrialized countries is also not completely desirable since they may become oriented toward techniques and technologies suited to these environments rather than to their own. Higher education in the developing countries themselves thus seems the most desirable method of producing capable, locally-oriented professionals. A serious remaining problem, however, is the length of time required for the development of such programs and for the actual education of the manpower.

Another approach to solving this problem is to reduce the requirement for architectural services. Highly industrialized construction techniques, such as modular box systems, might lessen this need on individual projects by as much as 50 percent (11). Such techniques, however, tend to be somewhat more capital-intensive than conventional methods, a definite drawback for developing countries, although the required labor may be able to be somewhat less skilled. The use of typified or model designs is another possibility along similar lines.

Novel application of computers is still another possibility, as mentioned in regard to the planning stage. In the developed countries the introduction of the computer has significantly increased the capability for designing large-scale facilities, and more exact methods of analysis and design have resulted in the construction of more efficient, complex, and elaborate structures. Moreover, there is a wide variety of standard programs covering many aspects of the analysis and design process, and the use of computers in highly repetitive and routinized activities is particularly promising. While most of these advances have been put into practice in the developing countries through the international firms, little effort has been made to study the effect of computers on increasing the efficiency and effectiveness of the limited locally available design capabilities. Of course, developing countries presently have little in the way of computer facilities, but this could be corrected relatively quickly. The maintenance and operation of computers requires only a year or so of training for someone with a technical school education in electronics, although the training of programmers in formulating computer problems in various building activities is more difficult and exacting. In this latter area the developing countries will probably have to rely upon international agencies and the industrialized countries for further research in computer applications of various aspects of design and in the development of standard programs. Novel application of computers thus seems promising and might not only substantially increase the productivity and capability of scarce local talent, but might additionally provide incentives for innovation and adaptation in design consistent with local conditions.

An aspect of design which receives relatively little attention is its influence on the technological nature of the assembly operation; that is, design essentially dictates the choice of technology, largely determining the resource mix and techniques. Consider, for example, a road project in mountainous terrain--if extensive cutting-and-filling is called for, it will be a rather capital-intensive project due to the need for heavy equipment; but if relatively little cutting-and-filling is called for and retaining walls are used instead, it will be a rather labor-intensive project. These decisions are made in the design, not the construction stage. A more quantitative example of this fact is given in Tables 3.6 and A3.9 where the labor and material requirements for multi-family housing are compared for conventional and industrialized building methods. The type, quantity, cost, and so forth of the labor, materials, and equipment, and the construction techniques, are quite different in the two approaches, but the approach is again selected during the design process. There is nothing inherently wrong with this except that the influence of design must be recognized. It is thus of utmost importance that the designer be completely aware of local conditions and prepare a design in accordance with them. The use of plans, specifications, and building codes which establish performance characteristics to be met rather than the materials and methods to be employed is one approach which might be used to reduce the influence of the design stage if that were deemed desirable, although this would require the contractor to have greater engineering and construction skills than otherwise.

In light of these considerations, it is important to note that studies on the feasibility of labor- versus capital-intensive construction

Table 3.6: Cost comparison of conventionally and industrially built high- and low-rise apartments in the U.S.[a] (source: ref. 62)

Type of construction	Cost per square foot of building (dollars)			
	Labor cost (shell)	Material cost (shell)	Total cost (shell)	Total direct cost (building)
Low-rise Rochester apartments[b]				
Conventionally built	2.55[c]	2.35[d]	4.90[e]	14.00
Industrially built	2.29[d,f]	1.71	4.00	13.10
High-rise New Haven apartments[g]				
Conventionally built[h]	3.67[i]	2.40[d]	6.07	14.07
Industrially built	2.02[d,j]	1.76	3.78	11.78

[a]Source (dated 1970) gives no year.

[b]Comparison of conventionally precast and prestressed concrete construction with drywall partitions and industrialized construction with precast walls and partitions and site-cast slabs. Labor cost, average: factory, $3.80 per hour; site, $7.80 per hour. Building is two stories, 840 square feet per dwelling unit.

[c]Man-hours per square foot of shell are 0.33.

[d]Includes labor cost for mixing concrete.

[e]At the average labor rates, the number of man-hours (factory and site) per square foot of shell is 0.37 man-hours.

[f]Cost breakdown per square foot as follows: engineering, $0.05 (2%); factory work, $1.00 (44%); site work, $1.24 (54%).

[g]Comparison of conventional concrete frame construction using masonry and drywall partitions and industrialized construction using precast walls and partitions and site-cast slabs. Labor cost, average: factory $3.75 per hour; site $7.15 per hour. Building is 16 stories, 915 square feet per dwelling unit.

[h]As the cost breakdown for conventionally built New Haven shell was not available, average of figures for 2 projects of similar New York construction was used.

[i]Man-hours per square foot of shell are 0.51.

[j]Using the ratio of factory-to-site labor and the above average labor rates, man-hours per square foot of shell are 0.34.

techniques in developing countries have done little more than simply mention that design might be important. The general outcome of these studies is that capital-intensive methods are more economically feasible than labor-intensive ones, but this is as expected since only a single design, one based on capital-intensive methods, is used in the analysis. What remains to be established is which is more economically feasible--a project designed for and built by labor-intensive methods or a comparable project designed for and built by capital-intensive methods. Case studies in this area are definitely needed.

3.3 Construction

The issues in development of the construction phase of the building process are divided into four required resource categories--management, capital, labor, and materials.

3.31 Management: The managerial aspects of the construction phase have only recently begun to receive the amount of attention they deserve, even in the developed countries. The functions of the contractor and his staff range from general office administration to estimating, bidding, planning, scheduling, monitoring and controlling job progress, and field supervision of construction. The manager must handle men, materials, equipment, money, and time, and the successful completion of the project is largely in his hands.

Figures on managers and administrators as a share of employment in construction range widely among different countries (see Tables 3.5 and A3.10). In both the U.S. and England the managers' and administrators' share of construction employment is significantly larger than that of the professionals or of the professionals and technicians combined.

Only the first of these comparisons is true of Latin America, however. A possible explanation of this, supported by the findings of an ILO study (17), is that in developed countries the building technician is generally responsible for field testing and inspection, while in developing countries his role is often that of site foreman or manager and a skilled worker takes over his traditional role. The practice of managers rising from the worker ranks or other positions in the industry, as is still relatively common in construction in developed countries, seems also to be somewhat the case in developing countries. For this reason, managers are seldom actually trained in management techniques. The largely negative impact of this on managerial efficiency, effectiveness, capability, and so forth is obvious and has been observed in industrialized countries. Reliance on foreign managers is probably another partial explanation of the small number of construction managers in developing countries.

This shortage of managers in Iran, Korea, and other developing countries is probably even more serious than in Latin America, if Colombia can be considered representative of the region, and the figures on managers and administrators in general representative of those in construction (see Table A3.8a). Although exact figures cannot be determined without more specific data for construction on an individual country basis, it appears that in most developing countries there is a shortage of managers for construction or at the very least a shortage of adequately qualified ones.

As for the clerical workers who serve to support the managers, there is much less of a discrepancy here between developing and developed countries (see Tables 3.5 and A3.8). This is as expected since the level of education and skill required for clerical work is much less than that for managers. Foreign contractors are more likely to use and, if necessary, train local people for clerical work, although they might also have the work done in their home offices. Nevertheless, there are probably some shortages in number and skills in the clerical field in construction in many developing countries. These shortages seem relatively easily correctable through the assistance of expatriate contractors and through increasing and improving training programs in the developing countries themselves, although it may be more difficult to train the teachers for these programs.

Developing and upgrading managers is a considerably more difficult and time-consuming process primarily because experience is so important. Efforts to train managers for developing nations in industrialized countries have not been too successful since they are not geared to local conditions such as handling large groups of relatively unskilled workers, and also because they tend to look upon themselves as superior, an attitude which ruins the work atmosphere. The training in educational and specialized institutions in the developing countries needs considerable upgrading and lacks practical, on-the-job aspects due to lack of contact with the industry itself. More work also needs to be done in the area of upgrading existing managers, in terms of improving their management skills, teaching them new ones, and persuading them to adapt to technological change. In Ethiopia, for example, the Ethiopian Highway Authority has a Training and Testing Branch which gives courses to upgrade workers and supervisors (12). Another approach to assisting existing managers might be to place the services of suitably qualified advisors or consultants at the disposal of individual firms for limited periods. A rather interesting program somewhat along these lines in Kenya is that of the National Construction Company, established by the government in 1967 to assist African contractors by obtaining work for them, giving them advice and training, and providing them with finance (12).

The industry itself should take a more active role in training, both in the area of upgrading existing managers and also in terms of helping to develop more practical, industry-oriented educational programs and providing some on-the-job training. As employer associations increase in number and strength, they might provide some of this assistance, and individual firms might also help in the funding of training programs. International agencies and developed countries might take part, especially in the training and upgrading of instructors and in setting up short courses for keeping managers up to date. Co-operative activities among developing countries also have some promise.

Another means for assistance in the development of contractors and managers are the expatriate contractors. Expatriate firms may bring in foreigners for all jobs including and above supervisory personnel, some of whom may have local assistants. Alternatively, they may joint venture with or subcontract a part of the job to local contractors depending upon their availability and capability. Only rarely do the international contractors provide explicit training and management assistance to such locals, but simply working with the expatriate firms on large projects generally results in local firms acquiring good experience and perhaps some contact with new management techniques.

The use of computers, as in planning and design, is another possibility which might help to increase the capability and productivity of present managers. In developed countries, computers are widely used for many standard firm operations such as accounting, payroll, and purchasing, and they are being used increasingly in construction-related activities such as project estimating, scheduling, monitoring, and control (based on network techniques like CPM and PERT). Standard programs are available in these areas, and some computer-based systems are currently being developed which integrate many of these operations within the framework of a network approach. Of course, computers can be of little assistance in the actual field supervision of manpower, but they do have considerable potential elsewhere in management in the developing countries.

As mentioned in Section 2.2, many of the organizational and structural features of the construction industry in developed countries seem to be carrying over to the industry in developing countries. In Korea, for example, most construction firms have been begun by businessmen in other industries, especially building materials, but more recently are also being begun by engineers and architects. The same is true in Iran, where the professionals are generally educated abroad (12). There are a large number of rather small firms in Korea, but 4.7 percent of them, licensed in both building and civil works construction, had an aggregate contract limitation of 49.6 percent of the tota contract limitations of all contractors in this field in 1972. Moreover, many of the firms are relatively diversified in their operations in that 84 percent of the licensed firms in 1972 could do both building and civil works construction (12). This is expected in Korea, however, for its construction industry is relatively advanced and foreign firms are now generally employed only for specialized work, particularly in the field of heavy industrial construction (see Tables A2.10a and A2.10b). In Ethiopia, on the other hand, local resident contractors of foreign nationality have played a prominant part in construction, and contractors of Ethiopian nationality are of relatively recent origin and have had to contend with considerable competition from resident Italian contractors (see Tables A2.12a and A2.12b). All local contractors tend to concentrate on building construction and to leave civil works to local branches of foreign contractors and to non-resident foreign firms, at least partly because most civil works have been financed by external agencies under conditions requiring at least some international competitive bidding (12). The easy entry/easy exit nature of the industry is exemplified by the high rate of attrition of firms in Iran due to rather intense competition (see Table A2.11c). Moreover, it is also reflected in the operations of major international construction firms working in developing countries. In construction, the true multi-national organizations, with well-established, permanent, operating subsidiaries in several countries, have not developed although international construction firms have been operating in the developing countries for many years. The instability of construction demand is at least partly responsible for this. Whether it is suitable for the developing indigenous industry to follow the industry in developed countries in terms of structure and organization is an issue of considerable significance.

Another matter of some importance is the nature of participant relations and contractual arrangements. Once again, the practices in developed countries, including independence of participants and lack of continuous working relationships, let alone vertical integration, and the extensive use of competitive bidding for construction contracts, are by and large carrying over to developing countries. The major negative and positive aspects of these practices in developed countries were discussed in Section 2.2, and alternatives were considered. In developing countries the use of these practices is even more questionable.

A major shortcoming of contractors in developing countries is their lack of managerial skills, such as work scheduling and field supervision, but even more serious with regard to competitive bidding is their inability to perform accurate cost estimating and a tendency to underbid. The use of a quantity surveyer, as is done in England, to provide a single list of quantities of materials upon which all bids are based, might be of some help with this particular problem. In road construction in Iran, for example, task schedules as well as quantity surveys are given to the contractor, and bidding is thus simply a matter of submitting a lowest cost estimate for the completion of a given set of operations over a given period of time (19). Furthermore, selection of the contractor should be based on conditions other than minimum cost such as extent of employment and training of local personnel and the use of local equipment and materials. A means to do this within the bounds of competitive bidding might include (1) requiring the submission, along with the bid price, of guarantees of minimum local employment, maximum value of imported materials and equipment, and maximum value of expatriate salaries; (2) using these guarantees to value the bid with shadow prices for labor, foreign exchange, and capital; and (3) choosing the bid with the lowest cost on a national economic profitability basis rather than the one with the lowest monetary cost.

In Korea, an increasing percentage of contracts are being let by negotiation, although the majority are still let by competitive bidding (see Table A2.5b). A rather interesting system used in Korea primarily for large projects is the optional contract system. Under this, the contractor who is awarded the first job, by negotiation or competitive bidding, has the option to negotiate for carrying out the remaining jobs provided his unit prices are within the government's cost estimate and at least as low as those in the first job (12). This is one means whereby the demand market for particular contractors might usefully be stablized. In Iran, 95 percent of public contracts are let by competitive bidding, as are 70 to 80 percent of the private ones, although this does not mean contracts are necessarily awarded to the lowest bidder (12, 19). A potentially suitable alternative to competitive bidding might be negotiation of a cost plus contract with a guaranteed maximum, with a share of any savings going to the contractor. The use of design-construct or turnkey contracts and construction managers are other possibilities warranting consideration.

3.32 Capital: The contractor needs both working and investment capital. Working capital covers payments for labor, subcontractors, materials, supplies, equipment rentals, overhead, and similar expenses. Contractors are almost universally paid by installments over the period of construction on the basis of work done. Further, a portion of the payments due to the contractor is almost always withheld as a guarantee against poor workmanship, hidden defects, and similar faults which might be observed only after project completion. Similar arrangements are usually set up between the contractor and subcontractor, with the subcontractor generally receiving his payment shortly after the contractor has received his from the client. Labor, on the other hand, is often paid on a weekly or even daily basis. UNIDO has estimated that this creates a need for working capital of from 2 to 10 percent of annual turnover (48).

Payment for building materials and other supplies may often be made in arrears in developed countries where the materials supplier may extend short-term credit to the contractor. As suggested by the figures in Tables 2.6 and 2.10a, equipment rentals (or depreciation) do not make up a very large share of construction cost, particularly in building construction; a UNIDO estimate places operating costs and rentals at between 2 and 5 percent of total cost (48). Finally, it is customary for the contractor to provide the general plant, including, for example, scaffolding and temporary structures and services, required by the various subcontractors.

It should be noted that these are the conditions that exist in the developed and the more advanced developing countries, but in many less-industrialized nations the small contractor may have to work under more difficult conditions, such as (1) payment from the client may be subject to unreasonable delays, (2) labor may be unreliable, (3) materials and supplies may have to be paid for on delivery, (4) equipment rentals may be nonexistent, (5) equipment may be expensive and breakdowns frequent, (6) cash flow may be unpredictable making forward planning difficult, and (7) short-term credit may not be available.

It has been repeatedly emphasized that construction is a rather labor-intensive industry. Investment in plant and equipment in construction is therefore comparatively low in both developed and developing countries although it might be expected to be somewhat less in the latter (see Table A3.11). According to a UNIDO report (48), capital formation by the construction industry accounted for less than 4 percent of the GDCF in 33 out of 39 countries studied over the period 1960 to 1965.

In developed countries, contractors in need of working or investment capital might use internal funds or might turn to commercial banks for short-term loans on the basis of their collateral. Alternatively, if they are incorporated, they might try selling corporate bonds or more stock. In developing countries, contractors try similar domestic sources but often encounter difficulties due to a variety of factors, including (1) many contractors have insufficient financial resources of their own; (2) normal financial institutions are often unwilling to extend credit to contractors, especially small or new ones who have little in the way of fixed assets; (3) contractors may have difficulty meeting the terms of normal loans; (4) management of financial resources by contractors in developing countries is often rather poor; and (5) capital and foreign exchange reserves necessary for the purchase of imported goods and services are generally in scarce supply.

The first step in beginning to alleviate this situation in the developing countries is to lessen the contractor's need to borrow working and investment capital. As for working capital, there are a number of possible ways for the government as client to assist, including (1) making progress payments on time; (2) providing interest-free or low-interest advances for working capital, as is already done quite often; (3) providing the materials that are required in large quantities, as is sometimes done in Korea for example (see Table A3.12); and (4) making arrangements to pay for materials that have been delivered to the site but are not yet incorporated in the facility. A private client might be encouraged to perform some similar services.

Means to lessen investment in equipment include encouraging firms to buy only equipment which can be fully utilized and to engage in equipment pooling. This pooling might occur in a variety of forms: (1) government equipment pools set up independently or in conjunction with a public agency which already owns equipment for its own operations (see Table A3.13 for data on government-owned and contractor-owned equipment in Korea); (2) development of private equipment leasing companies (for example, rather specialized rental firms are quite common in Iran, where operations are generally on a "wet lease" basis [i.e., include operator, maintenance, and fuel] [19]); and (3) pooling of equipment owned by contractors and subcontractors. Another means to lessen this investment might be to purchase used and reconditioned equipment from foreign contractors who are leaving the country or from abroad through a government or private agent.

Another approach to alleviating the financial difficulties of contractors in developing countries is to make it more feasible for them to borrow working and investment capital. The first step is to improve their ability to manage financial resources through additional education or short training programs for managers, and the second is to develop incentives for contractors to save and reinvest profits. The governments of some developing countries own and operate materials and equipment manufacturing plants and might set an example for the private sector by providing the contractor with short-term credit for purchases of such goods. In Iran, for example, most equipment purchases are already financed by the dealers, and losses have been small (12). In some developing countries where normal financial institutions are reluctant or unwilling to finance contractors, a number of construction enterprises have joined forces and established a special institution to provide financing for contractors (e.g., Bank Kar in Iran and Contractor's Financial Cooperative of Korea [CFCK] [12]). These have by and large been quite successful in themselves, but even more importantly they have often resulted in the more normal financial institutions' taking on the financing of contractors. Another approach to encourage normal financial institutions to finance contractors might be for the government to provide incentives or to provide facilities to insure such credit risks. Finally, too, public funds might be provided for contractor financing, perhaps through industrial development banks. The National Construction Company is doing this in Kenya, but so far has not been too successful (12).

An additional comment should be made on the impacts of the resource mix and timing of investment on both the contractor's and client's needs for capital. The resource mix affects the contractor's needs for working as opposed to investment capital and local currency as opposed to foreign exchange. It might similarly, although less directly, affect the type of funds the client needs. The government may thus devise financial policies to influence the use of various technologies; for example, the purchase of equipment might be discouraged by regulation of exchange rates, by increasing interest rates, by implementation of duties on imported equipment, or by elimination of depreciation allowances on equipment (21).

The timing of investment also influences the contractor's and client's needs for funds. Since there is a fair amount of uncertainty associated with the future funding of projects, the general tendency is to request the maximum amount available for present funding and spend it immediately, resulting in overdesign and neglect of maintenance. Staging of construction is an excellent way to alleviate this problem and to defer costs both for the client and the contractor. This is a procedure whereby a facility is built initially to meet the immediate demands of the user and is then upgraded through reconstruction to meet increased demand. By taking a large project and thus breaking it up into a series of smaller projects over a longer period of time, the contractor's needs for working and investment capital and the client's needs for funding are decreased in the short run, and in the long run may even be decreased due to more efficient utilization of resources or to unforeseen changes in demand.

Two final topics related to contractor financing are bonding and insurance. The surety bond is a universal element in construction throughout the industrialized world and is becoming so in the developing world. A surety bond is an agreement by the bonding company to indemnify the owner to the extent of the bond's face value for nonperformance by the contractor. It is in no way insurance for the contractor since he is required to indemnify the surety against any claim that may be brought against it because of his failure to perform in the prescribed manner. Some of the most frequently used bonds include (1) bid--guarantees that the bidder, if awarded the contract, will execute the contract with the owner; (2) performance--guarantees performance in accordance with the terms of the construction contract; (3) payment--guarantees that the contractor's bills for labor and materials incurred under the contract will be paid; and (4) maintenance--guarantees to rectify defects in workmanship or materials for a specific period of time following completion. Contractors with limited experience or assets often have a hard time getting such bonding except at the cost of very high premimums, and means to alleviate this situation need to be worked out. For example, the government might provide facilities for provision of bonds or for insuring bonding companies against such risks. Alternatively, some other forms of guarantees might be used; for example, the performance and maintenance bonds might be replaced by retention of a part of the contractor's progress payments, and the payment bond by withholding the contractor's progress payment until he shows evidence that all labor, suppliers, and subcontractors have been paid for the period.

Responsibility, liability, and insurance is an important but complex topic in construction. Construction projects generally have several contractual arrangements in effect at any point in time which together establish a complicated structure of responsibilities for damages arising out of construction operations; for this reason, all participants need insurance. In developing countries, however, insurance is still a somewhat new idea and, like financing and bonding, is difficult for the contractor who is new or inexperienced or who lacks assets. The government might help by developing some facilities for providing insurance or by accepting some of the contractor's responsibilities itself when it is the client and encouraging other clients to do the same. Development and implementation of new insurance arrangements, such as the wrap-up insurance programs which cover all participants (owner, architect, engineer, general contractor, and subcontractors), is another possibility.

3.33 Labor: A common condition of underdevelopment is an abundance of labor. Data on unemployment, which generally relates to persons out of work and seeking work for pay or profit during a particular reference period are shown in Table 3.7. Differences in the level of development and in accounting procedures at least partly explain the discrepancies noted in this table. In the developing countries there is also usually a considerable amount of underemployment, which is nearly impossible to quantify. An ILO employment study in Colombia suggested that perhaps 30 percent of the available labor was unutilized. Similar figures could be cited for Kenya, Ceylon, and several other countries, but definitions and concepts differ and data is sketchy (7). Some forms underemployment takes include (1) persons who cannot find wage employment, cannot afford protracted unemployment, and thus take up some form of non-wage employment as a means of subsistence; (2) persons in the wage and non-wage work force whose productivity is so low that they could be withdrawn from employment in their activity with very little, if any, resulting loss in output under existing conditions of technology and work organization; and (3) persons working shorter hours during the work week than they desire who are seeking additional employment, and persons who are seasonally unemployed.

The extent of this over-abundance of labor naturally varies from one country to the next, and from one region to another, and the immobility of labor forces may cause a scarcity of labor in one area while severe unemployment exists elsewhere in the country. In Brazil, for example, large labor forces in the northeastern part of the country cannot be induced to move to the central region where highly capital-

Table 3.7: Unemployment rates in Korea, Kenya, Colombia, Iran, and the U.S. (percentages[a]) (source: ref. 18,22,36,55)

Year	Korea[b]	Kenya[c]	Colombia[b,d] (Bogota)	Iran[e]	U.S.[b]
1953	na	na	na	na	2.9[f]
1956	na	na	na	2.6	na
1963	8.1	8.3	8.7	na	5.7
1964	7.7	na	7.2	na	5.2
1965	7.4	11.4[g]	8.8	na	4.5
1966	7.1	10.8	11.5	4.6	3.8
1967	6.2	8.1	12.7	na	3.8
1968	5.1	na	11.6	na	3.6
1969	4.8	na	na	na	3.5
1970	4.5	na	na	na	4.9
1971	4.5	na	na	na	5.9
1972	4.5	na	na	na	5.6

[a] Percentages are calculated by relating the unemployed to the total of employed and unemployed.

[b] Based on labor force sample surveys. Unemployed include persons seeking work whether or not they were previously employed and persons available for work who were previously employed, including those temporarily laid off (U.S. and Korea - ref. 22; Colombia - ref. 36).

[c] Based on applicants registered for work - male only (ref. 55).

[d] Age 14 and over until 1965, thereafter age 10 and over.

[e] Based on census data. Unemployed include only those persons actively seeking work and exclude seasonally unemployed agricultural workers (ref. 18).

[f] Excludes Alaska and Hawaii (ref. 55).

[g] Average of less than twelve months.

intensive techniques are consequently being utilized on the cross-Amazon highway project. The extent of over-abundance of labor also varies over time, and large labor supplies may not be continuously available. At the peak of the planting and harvesting seasons, for example, all available labor may be needed on the farms, while during the slack seasons there is a surplus of labor.

Aside from these questions on the availability of labor on a local, national, and continuous basis, there are questions with regard to the appropriateness of this abundant labor force for industrial activities. By and large, it is seriously lacking in skills and experience (see Tables A3.8b and A3.14). The literacy rate of the adult population in many developing countries is very low (see Table A3.15). Another indicator of the quality of the available labor is its health and level of nutrition. The populations of developing countries tend generally to be undernourished in terms of the energy (calorie) and protein content of their food intake (see Table A3.16), and this not only creates poor living conditions but also may account for low productivity and the inability to do strenuous work. Finally, most developing countries lack any industrial traditions; most are agrarian, and the growing urban areas are thus populated mainly by former farmers acquainted only with primitive agricultural methods. Not only have the available workers had little experience with machinery and thus have scant perception of the disciplines required or of the risks incurred when dealing with heavy equipment, but they also often have a concept of time different than the tempo of modern industry.

The demands that the production phase of the construction process places on labor are considerable. On-site labor is, on the average, nearly 30 percent of total construction cost (see Table 2.10). The deviations from this may be due to differences in definition and type of construction, but they are probably also due to differences in the level of development. In the U.S., for example, production tends to be highly mechanized and materials to be largely prefabricated so that relatively little on-site labor is used. In the least-developed Ethiopia and even Kenya, labor is cheap in relation to the expensive imported materials, and on work done by expatriate firms production may be fairly mechanized. In the more-developed Korea, however, competition for labor has increased and with it its wages, materials have become less expensive as less reliance is placed on imports, and nearly all work is done by local firms probably using fairly labor-intensive technologies.

The labor required for the production phase, including foremen and skilled, semi-skilled, and unskilled workers, makes up from 80 to 90 percent of employment in construction (see Table 3.5). This figure, compared with the shares of these categories of workers in the total labor force as given in Tables 3.5b, 3.5c, and A3.8a, shows that construction employs a rather disproportionate share of such labor, suggesting that construction is a labor-intensive activity. The composition of the production labor force for construction appears to be very different in developed and developing countries (see Tables 2.11, 3.5a, and 3.5b for developed countries and Tables 3.5c and 3.8 for developing countries). For the developed countries, the proportion of skilled labor is somewhat greater than that of unskilled labor and is many times that of semi-skilled labor, while for the developing countries unskilled and semi-skilled labor largely comprise the labor force. While some of this difference between the developed and developing countries can be attri-

Table 3.8: Employment in the construction industry in Korea (source: ref. 12)

Year	Ordinary labor (thousands)	Ordinary labor (percent)	Skilled labor (thousands)	Skilled labor (percent)
1963	199	96.2	7.9	3.8
1964	192	95.8	8.5	4.2
1965	245	96.5	9.0	3.5
1966	213	95.8	9.4	4.2
1967	264	96.4	10.0	3.6
1968	317	96.8	10.5	3.2
1969	333	96.7	11.2	3.3
1970	279	96.1	11.3	3.9
1971	327	96.5	12.0	3.5

buted to differences in definition, the mix of constructed facilities being produced is also important. In developing countries, as was noted in Section 2.1, construction tends to be largely focused on infrastructure creation, while data in Tables 2.12 and 2.13 for the U.S. show that public works construction requires smaller proportions of skilled labor and larger proportions of semi-skilled and unskilled labor than does building construction. One last and very important factor which helps to account for this difference between developed and developing countries is that there is generally a shortage of skilled labor in developing countries. Construction methods which can use a relatively high proportion of unskilled and semi-skilled labor thus are used, and when skilled labor is needed but not available, men are trained on-the-job but only in a limited way and only for the purposes of the particular project.

Thus the abundant natural resource, labor, is suitable for construction only under certain conditions. Laborers must be induced to come to work on construction projects, which may involve costs to the project in the form of suitable relocating and living arrangements. Much of the available labor will need training, although it is also perhaps useful to try to use construction techniques requiring relatively unskilled labor. Illiteracy is also a problem in construction in that this necessitates special training programs and means that few of the workers can read blueprints. Finally, malnutrition and poor health and a lack of industrial traditions pose problems for construction and must be taken into consideration in assessing the appropriatness of the abundant labor force.

<u>Training</u>: It appears that in most developing countries there is

a need both for additional and better qualified workers in construction. The common reasons cited for these shortages are a lack of training facilities, shortage of instructors, and low job status and pay. These conditions and the fact that workers are less able, due to their lack of training, to move up to the position of site supervisor/foreman also have created a general shortage of qualified foremen.

As is the case in industrialized countries, training for work in construction in developing countries ranges from formal institutional training to informal on-the-job training. A study of the education and training requirements of various industries, based on the 1950 population census in the U.S., shows construction's requirements to be among the highest, 10.6 years of general educational development and 2.3 years of specific vocational preparation* (53). In recent years, many developing countries have established apprenticeship schemes for the construction industry which include the drawing up of standards for training in particular trades, the making of arrangements to provide basic training and related instruction and the training of instructional staff, and the adoption of measures for supervision and control of apprenticeship and for trade testing. Nevertheless, such systematic apprenticeship has contributed little to the manpower needs of the industry. A variety of reasons appear to account for this, including (1) building contractors are reluctant to take on apprentices under officially controlled schemes; (2) difficulties are encountered in arousing interest in apprenticeship among potential entrants; (3) admission conditions are often so high that there is a lack of qualified candidates; and

*This includes vocational education in schools, apprenticeships, on-the-job training, and acquisition of essential experience.

(4) responsible training bodies are not yet equipped to provide the necessary guidance. To some extent, developing countries have set compulsory ratios for employment of apprentices, but these have been generally unsuccessful. Data on apprenticeship in the U.S. and Great Britain suggest that it is more important in Great Britain than in the U.S., but in the latter country these programs do not supply enough new workers to maintain the size of the current labor force (see Table A3.17), and the role of apprenticeship programs has largely become one of producing the key workers who rise to supervisory and training positions.

Secondary vocational or trade schools, which include building trades sections, exist in most developing countries, but their enrollment is generally quite small (see Tables 3.9a and A3.18). Their lack of candidates, high drop-out rate, and lack of contact with the industry itself have resulted in vocational training programs contributing few skilled workers to the construction industry in both developed and developing countries. Figures in Table 3.9b for Latin America, for example, show that only five percent of all operatives and artisan workers have more than a primary education, with two percent in technical schools and three percent in general secondary education. The military is yet another source for training of construction workers, although the level of training coverage is often not great. In Korea, a fairly significant number of construction workers have been trained by this means (12).

Some other formal training schemes include (1) special training centers organized for the sole purpose of training construction workers, such as the Construction Workers Training Center established by the

Table 3.9a: Enrollment in educational institutions[a] in Colombia, Ethiopia, Iran, Kenya, Korea, and the United States (source: ref.55)

Country and year	Pre-primary	First level	Second level: General	Second level: Vocational	Second level: Teacher training	Second level: Total	Third level	Special
Colombia (1968)	110,494	2,733,432	407,966	191,573	54,527	654,066	85,339	6,797
Ethiopia (1969)	na	590,445	105,652	6,168	2,623	114,443	4,636	3,270
Iran (1969)	20,214	2,916,266	897,443	23,335	9,275	930,053	67,268	2,086
Kenya (1970)	na	1,427,589	126,855	2,136	8,017	137,008	4,967[b]	1,849
Korea (1969)	21,658	5,622,816	1,441,700	259,601	na	1,701,301	186,675	3,947
United States (1969)	–[c]	31,955,000[c]	na	na	na	19,674,000	7,916,991	2,439,000

[a]Figures include both public and private schools, excluding adult education and correspondence schools. Part-time students are generally included only at the third level and in vocational education at the second level. Pre-primary is defined as education preceding the first level provided for children who are not old enough to enter school at the first level (e.g., at nursery school, kindergarten, infant school). First level education is that with a main function of providing basic instruction in the tools of learning (e.g., at elementary or primary school). Its length may range from four to nine years depending on the organization of the school system in each country. Second level education is based upon at least four years of previous instruction at the first level and provides general or specialized instruction of both (e.g., at middle school, secondary school, high school, vocational school, teacher training school at this level). Third level education requires, as a minimum condition of admission, the successful completion of education at the second level or evidence of the attainment of an equivalent level of knowledge (e.g., at university, teacher's college, higher professional school). Special education covers all general or vocational education given to children who are physically or mentally handicapped, socially maladjusted, or in other special categories.

[b]Data relates to 1968.

[c]Pre-primary enrollment is included in figure for first level.

Table 3.9b: Hypothesis on the educational profile of the labor force in Latin America in 1965 and a hypothetical projection for 1980 (source: ref. 52)

Year and educational level	Percentage composition by educational level					
	Total	Professional and technical personnel	Administrative and managerial staff	Employees and salesmen	Operatives and artisan workers	Services personnel
1965						
Total[a]	100.0	100.0	100.0	100.0	100.0	100.0
University training (complete and incomplete)	1.4	23.7	10.0	2.0	-	-
Secondary education	11.4	53.8	45.4	35.2	5.0	5.1
General secondary	8.2	23.0	40.2	30.2	3.0	5.1
Complete	2.0	10.1	15.1	10.1	-	-
Incomplete	6.2	12.9	25.1	20.1	3.0	5.1
Technical	2.3	5.0	5.2	5.0	2.0	-
Teacher training	0.9	25.8	-	-	-	-
Primary education	87.2	22.5	44.6	62.8	95.0	94.9
More than three years	38.6	13.2	24.9	34.9	40.0	45.0
Less than three years or none	48.6	9.3	19.7	27.9	55.0	49.9
1980						
Total[a]	100.0	100.0	100.0	100.0	100.0	100.0

(continued)

(Table 3.9b continued)

Year and educational level	Total	Professional and technical personnel	Administrative and managerial staff	Employees and salesmen	Operatives and artisan workers	Services personnel
	Percentage composition by educational level					
University training (complete and incomplete)	2.0	24.6	13.1	2.7	-	-
Secondary education	21.2	65.7	60.7	44.8	14.0	8.1
General secondary	12.8	20.8	46.3	36.5	7.2	8.1
Complete	3.7	10.0	30.6	23.0	1.8	1.9
Incomplete	9.1	10.8	15.7	13.5	5.4	6.2
Technical	6.9	16.0	14.4	8.3	6.8	-
Teacher training	1.5	28.9	-	-	-	-
Primary education	76.7	9.7	26.2	52.5	86.0	91.9
More than three years	47.9	7.2	18.8	38.2	52.0	60.4
Less than three years or none	28.8	2.5	7.4	14.3	34.0	31.5

[a] Percentages are based on the following figures for the total labor force: 1965 - total 76,416,000, professional and technical 2,787,000, administrative and managerial 2,312,000, employees and salesmen 8,543,000, operatives and artisans 53,484,000, and services personnel 9,290,000; 1980 - total 120,000,000, professional and technical 6,310,000, administrative and managerial 3,705,000, employees and salesmen 14,820,000, operatives and artisans 80,485,000, and services personnel 14,680,000.

Korean Contractors Association in 1967 (12); (2) accelerated training centers often set up with direct reference to requirements under economic planning; (3) mobile units used to complement training given in a fixed center or to provide short intensive courses in limited skills to people who would not otherwise have ready access to training for construction; (4) training for construction work as a component of youth employment and training schemes, prevocational training, and community development programs; and (5) upgrading and retraining programs for workers in the industry, such as the training center set up by the Training and Testing Branch of the Ethiopian Highway Authority for the purpose of upgrading its own force of skilled workers and supervisors (12).

By and large, the major means of skill acquisition in developing countries is through informal training on the job or through a more traditional form of apprenticeship. To a somewhat lesser extent, this is also the case in industrialized countries. For example, a study (8) of 784 workers* (including bricklayers and tile setters, carpenters, electricians, and operating engineers) in upstate New York in the U.S. found that 21.6 percent of the workers indicated informal on-the-job training as their only source of skill acquisition**, 90.3 percent of non-apprentice workers indicated it as one of their sources, and as many of the non-apprentice workers received some of their training from friends and relatives as did from vocational education and military training combined. The extent of training necessary varies among

*Of these, 280 either did not answer in any way or had taken apprenticeship and were not included in the numbers who received training from other sources. This leaves 504 non-apprentice workers.

**This is 33.5 percent of the non-apprentice workers.

crafts, of course, and as shown in Table 3.10 some trades in the U.S., for example, rely quite heavily on formal training of some sort. On-the-job training in developing countries generally produces workers with simple skills, at best at the semi-skilled level, and trains them only for the immediate needs of the job at hand. International contractors also train workers on the site to perform work normally carried out by skilled craftsmen, but in this case complex jobs are generally broken down into highly specialized components, and thus the workers learn only narrowly specialized skills. The major skills produced in this manner include equipment operators, maintenance mechanics, welders, carpenters, shutterers, and, to a lesser extent, plumbers and electricians (17). A more traditional form of apprenticeship, whereby a master craftsman takes on young people and provides them with instruction and work experience, is also commonly practiced in developing countries, although such a system fails to produce the kind, level, and quality of skill that the developing countries need and that more formalized methods produce.

There is little question that training in developing countries needs improvement, both in terms of upgrading and expanding existing programs and of developing new ones. Adequate training of skilled workers must necessarily consist of three elements--provision of an adequate educational basis, systematic instruction in efficient techniques of work, and supervised application of these techniques in real work situations. One means to accomplish this might be through an apprenticeship system which combines training in employment and intensive short-term courses on a group basis during slack periods. Development of National Industrial Vocational Training Schemes as in Ethiopia and Kenya

Table 3.10: Percentage of each craft that learned the trade through formal training[a], determined by a survey conducted in April 1963 in the U.S. (source: ref. 5,28)

Construction craftsmen	Percent that learned trade through formal training
Brickmasons, stonemasons, and tilesetters	44.7
Carpenters	31.1
Electricians	72.9
Excavating, grading, and road-building machine operators	11.2
Painters	27.8
Plumbers and pipefitters	55.0
Tinsmiths, coppersmiths, and sheet metalworkers	70.9
Cranemen, derrickmen, and hoistmen	17.5
All construction craftsmen	39.4

[a]Including apprenticeship, technical school training, and training in the armed services.

is another possible approach (24,25). Training programs, however, must be tailored to the conditions of the particular country, and thus no generally applicable patterns can be established. Responsibility for worker training must be shared by proper government agencies, employers' and workers' organizations, and individual firms and workers. Greatly increased provision for upgrading and retraining of workers already in construction is also of utmost importance.

Training and retraining of instructors for these programs is also necessary, and here it seems international agencies and developed countries might be of some assistance as might co-operative activities among developing countries. In the long run it is probably best that these instructors rise from the ranks of the better qualified craftsmen who have had considerable field experience. In Iran, for example, the Industrial Training Board for twenty-six industries, including construction, has an interesting program somewhat along these lines. The Board, which was established by the government in 1971 and is financed by an industrial training levy of 2 percent on turnover, has set up a range of public and private vocational training centers which provide numerous industry-based in-service training courses for the purpose of developing training officers within firms. A Staff College for the purpose of developing a corps of people who want to take up industrial training as a career is also planned (12).

As was mentioned earlier in this section, there is also a shortage of adequately qualified foremen. Their current responsibility for on-site training re-emphasizes the importance of their own education. The principal sources of recruitment for foremen are building technicians and skilled workers, with the largest number coming from the former group. The major difficulty with the technicians is their scarcity and lack of practical experience. If improved and selective training is organized for craftsmen, however, these difficulties may be overcome by recruiting foremen from the ranks of skilled workers, as is more often done in industrialized countries. Nevertheless, additional training in a variety of supervisory and other foremen-related functions will be needed for the craftsman if he is to become a foreman, and programs for upgrading and updating foremen need improvement, expansion, and development.

Productivity: Productivity in construction as well as in other industries is a topic which receives considerable attention in developed as well as developing countries. Only labor productivity is generally considered, however, and a major shortcoming of labor productivity is that it fails to consider the other input factors of capital and materials. Technological change, which is thought to be largely responsible for productivity increases, frequently changes the mix of inputs as well as their quality. It would therefore be useful to look at the various input productivities or at a total factor productivity which is a weighted combination of all inputs, thus cancelling the effects of factor substitutions. The data to do this even in developed countries, however, is very sparse, and for this paper only labor productivity will be considered while bearing these other factors in mind.

The measurement of labor productivity is a problem even in developed countries due to the heterogeneous nature of construction inputs and outputs. Productivity differs among types of construction, crafts, geographic locations, sizes of project, and so forth and changes over time (see, for example, Tables 2.12 and 2.13 where man-hours per 1000 dollars of construction cost or 100 square feet is essentially an inverse measure of productivity). In developing countries only rough indicators of productivity, such as GDP or value added in a particular sector per person in the economically active population or employed in the same sector are available. Such figures for Colombia, Iran, Korea, Kenya, Ethiopia, and the U.S. are given in Table A3.19, and while these are far from exact measures of productivity, they do seem to exhibit the general trends in labor productivity that one might expect.

Some general observations one might draw from this data are that (1) productivity in the developing countries is less than that in the U.S. in all sectors considered; (2) productivity in construction is generally less than that in manufacturing and greater than that in agriculture in both the developing coutnries and the U.S., with the exception of Kenya; (3) productivity in construction in Colombia and especially Korea seems to grow faster than that in manufacturing, while in the U.S. it grows slower if at all; (4) productivity in manufacturing in Colombia and Korea, in turn, seems to grow slightly faster than that in agriculture, although the opposite is true in the U.S. where agriculture has been undergoing rapid mechanization; (5) productivity growth in the developing countries as compared with that in the U.S. is generally greater in construction and less in agriculture, with no consistent pattern for manufacturing; and (6) change in productivity in Korea, Colombia, and the U.S. has been generally upward, with the exception of construction in the U.S., and has been fairly considerable, especially in Korea, whereas productivity in Kenya has fluctuated greatly and the overall change has been less. Further explanations of these observations may lie in the particular conditions of the individual countries concerned as well as of the developing versus developed countries.

Efforts to improve labor productivity in construction in developing countries must begin with an identification of the factors affecting productivity, their relative importance, and their potential for alteration. Five general categories of factors can be identified--(1) natural conditions, (2) the nature and quality of management and organization, (3) the nature and quality of labor, (4) the availability of capital, and (5) the level of technology. Under natural conditions parameters such as climate, topography, geology, soil conditions, and vegetation are included (e.g., see Table A3.20) as well as the type of construction and of work involved. Relatively little can be done to alter these conditions, but they must be kept in mind when selecting production techniques if productivity is to be maximized.

Some of the more important managerial factors include (1) the organization, management, and supervision of the site from the initial planning and scheduling to the completion of the project (e.g., see Table A3.21); (2) the conditions of employment of labor (e.g., see Table A3.22) and the state of labor-management relations; and (3) the nature of the industry and of individual firms in terms of competitive pressures, degree of specialization, size of operations, and potential for economies of scale. These managerial factors, by and large, have considerable potential for change or development in the direction of significantly improving labor productivity.

The next group of factors relate to the nature and quality of the labor force. The first of these is the attitudes and traditions of the workers themselves which are largely intangible and therefore difficult to alter. The second factor is the health, nutrition, and physical well-being of the worker, often a very serious problem in developing countries. An ILO study (4) on construction of the Sharavathi Valley Project in India, for example, found that Malabar workers had an average daily output 80 percent greater than that of non-Malabar workers, which the ILO attributed to the fact that a Malabar worker consumes 1620 more calories per day. Another study (13), done by the IBRD, of iron deficiency anemia in Indonesia, which is largely caused by hookworm infestation and poor dietary intake of iron, found the productivity of non-anemic laborers to be about 20 percent greater than that of anemic laborers. One means which may begin to alleviate such situations is payment in food rather than money; another is further provision of medical and sanitation facilities. The level of skills of the work force is the final factor, and this depends upon the existence of traditional skills, the level of education, the literacy rate, and the quality, breadth, and availability of training and retraining programs.

The fourth set of factors influencing labor productivity involves the availability and use of capital in the form of investment in plant and equipment. In the majority of developing countries there is a shortage of capital, particularly of the foreign exchange needed for the initial purchase of equipment (which tends to be high due to transport charges, import duties, and the like) and its upkeep in the form of fuel and spare parts. The low utilization, poor maintenance, frequent breakdowns, and costly repairs of such equipment tend to result in higher overhead costs in the developing countries, and the use of equipment tends to reduce the amount of unskilled labor on the site. Thus, while investment in equipment in the industrialized countries has helped to raise labor productivity, it is not clear that this is the route to follow in developing counries, although investment in some, especially locally produced, equipment might be advantageous.

Closely related to this is the fifth and final group of factors which influence labor productivity, the level of technology or, more specifically, the mix of inputs of labor, capital, and materials, and the method of construction. As has often been noted, construction tends to be a labor-intensive activity even in industrialized countries, yet as labor has become increasingly costly relative to other inputs, there has been a tendency to try to raise productivity by replacing labor with equipment (see Table A3.23) and by using labor-saving materials and prefabricated components and systems, although the success of these efforts is not yet clear (see Table 2.13). Whether or not this is appropriate for developing countries is additionally highly questionable because of their capital shortages, labor abundances, and lack of infrastructure. It does seem, however, that the development and use of new and improved techniques, such as processes which can be broken down into simple operations, standardization of components, processes, and designs, some on-site prefabrication, and general rationalization of work on the site, which require less skilled labor and result in more efficient use of available equipment would be worthwhile at least until workers can be trained and the further industrialization of construction is appropriate.

Conditions of Work: Conditions of work in the construction industry are notoriously bad in both developed and developing countries. Whether one looks at construction's shares of total employment and unemployment (see Tables 2.3b, A2.3, and A3.24) or the rate of unemployment in construction (see Table 3.11) relative to other industry sectors, it is evident that construction has a disproportionally large share of un-

Table 3.11: Unemployment rates[a] for specific industrial groups, in the U.S. and Korea (percentage) (source: calculated from Tables A2.3 and A3.24)

Country and industry	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972
United States[b]										
Construction	13.8	11.7	10.6	8.3	7.8	7.3	6.4	10.4	11.6	11.7
Manufacturing	5.9	5.2	4.1	3.3	3.9	3.4	3.4	5.3	7.0	5.7
Agriculture, forestry, and fishing	3.5	3.7	2.7	2.4	2.6	2.4	2.1	2.8	3.1	3.0
Total	5.8	5.3	4.6	3.9	3.8	3.6	3.5	4.9	5.9	5.6
Korea[c]										
Construction	6.5	7.7	7.5	6.2	7.4	6.8	6.5	4.5	4.9	10.0
Manufacturing	9.3	8.6	6.5	4.6	5.1	4.1	4.3	3.7	3.8[d]	5.4[d]
Agriculture, forestry, and fishing	1.4	1.3	1.1	1.2	0.8	0.8	0.6	0.6	0.6	0.4
Total	8.1	7.7	7.4	7.1	6.2	5.1	4.8	4.5	4.5	4.5

[a] See footnote a, Table A3.24. Unemployment rate is unemployment, divided by the quantity employment plus unemployment, and multiplied by one hundred percent.

[b] Persons aged 16 or over, except 1963--1966 aged 14 or over for unemployment figures. Employment figures for construction and manufacturing are from statistics of establishments in the private sector rather than labor force sample surveys.

[c] New industrial classification came into effect in 1971.

[d] Excludes all repair services.

employment. Although the problem appears more serious in the U.S., where construction's unemployment rate is twice the all-industry figure, it seems to be an increasing problem in Korea, where the unemployment rate in construction has not been declining as it has in other industries and in recent years has been larger than the all-industry figure. The unemployment problem in developing countries is probably less apparent because of the use of day laborers (see Table A3.25) and the way in which workers in rural areas divide their time seasonally between construction and agriculture.

The labor force in construction is generally a floating one, hired on a project-by-project basis, and the demand for labor is thus closely linked to the fluctuating demand for construction. The outcome in both developed and developing countries is employment instability (see Table A3.26). Periodic instability, arising largely from economic and political conditions, seems especially serious in construction in developing countries. An ILO report (23) suggests three reasons why this may be true--(1) failure to forecast on a long-term basis the major investment requirements of the industrialization process; (2) construction projects in national development plans may not be executed due to political instability or exchange crises; and (3) a rather small number of relatively large infrastructure projects tend to characterize the early stages of the industrialization process. Seasonal fluctuations, on the other hand, may actually be a less serious problem in the developing than in developed countries, although in some there are problems with the monsoon season. The temporary nature of construction work due to its project-orientation and the periods of unemployment which most workers encounter between projects are probably equally serious in both developed and developing countries. The impact of this on the individual, however, may be less in developing countries in that construction is often considered temporary seasonal work or a stepping-stone to employment in manufacturing. This is hardly a satisfactory solution to the problem, however, since the successful growth of the construction industry requires the development of a permanent and committed labor force. Finally, technological unemployment and intermittent occurrences on the job, such as accidents, work stoppages, and management and labor inefficiencies, also contribute to employment instability.

Such employment instability is highly undesirable both from the standpoint of encouraging workers to enter the industry and of using to the fullest extent the labor force that is available. Greater efforts to reduce this instability must be made; some of these might include (1) explicitly including construction in national development plans; (2) easing reliance on construction as a short-term economic regulator through appropriate monetary, fiscal, and tax policies; (3) developing a construction labor market information system; (4) planning public works projects so as to stabilize construction demand; (5) establishing fiscal or related measures to encourage off-season construction or to offset its costs; (6) promoting the development and use of all-weather construction techniques; (7) increasing foreign aid tied to specific projects; and (8) improving continuity in the operations of local and foreign firms. At the same time, however, it is important to realize that all of the instability can never be alleviated, and thus efforts must also be made to reduce its impact. These might include providing compensation funds, making guarantees of a certain number of hours of work per week, increasing worker mobility, and providing aid to workers in pursuit of work through special information and employment services. In Colombia, for example, workers in the construction industry receive three days of wages for every month worked as unemployment compensation (23).

Hours of work is a topic closely related to the question of employment stability. Average hours of work per week in construction are generally lower than those in manufacturing and in the non-agricultural sector of the economy in both developing and developed countries (see Table A3.27), and hours worked in construction are also generally subject to greater fluctuations. Legislation establishing maximum hours of work per day and week with and without extra compensation is quite common and may help to alleviate a part of the problem if it is enforced. Another possible solution, particularly in countries where the industry is less developed, is legislation establishing minimum hours or some sort of unemployment compensation. Where employers' and employees' associations exist, a more voluntary arrangement between them may be possible.

Wages are of course another issue of importance in construction in both developing and developed countries, but for rather different reasons. Wages in construction in developed countries in general tend to be higher and to grow somewhat faster than those in manufacturing (see Table 2.5); data on the U.S. in Tables 3.12a, 3.12c, and A3.28 demonstrate this fact and also show wages in construction to be higher than those in agriculture and the non-agricultural and total economies as wholes and to grow somewhat faster than in these other sectors, with the exception of agriculture. There are a variety of factors which are considered at least partly responsible for these higher and faster

Table 3.12a: Average earnings per worker in construction, manufacturing, agriculture, and the total non-agricultural sector in Korea and the United States (source: ref. 22)

Country and industry		1963	1964	1965	1966	1967	1968	1969	1970	1971	1972
Korea (won)											
Construction[a,b]	(per month)	na	na	na	na	na	na	na	23,174	26,298	31,250
Manufacturing[a,c]	(per month)	3,180	3,880	4,600	5,420	6,640	8,400	11,270	14,150	17,349	20,104
Agriculture[d,e]	(males)(per day)	143	199	221	256	307	381	463	579	695	803
	(females)(per day)	91	124	141	165	207	260	316	392	472	552
Non-agricultural sector[a,b]	(per month)	na	na	na	na	na	na	11,610	17,363	20,988	23,146
United States (dollars)											
Construction[f]	(per hour)	3.26	3.43	3.55	3.76	3.99	4.26	4.64	5.08	5.49	5.84
	(per week)	111.36	122.79	128.16	136.49	145.64	153.79	169.82	184.40	197.64	209.07
Manufacturing	(per hour)	2.46	2.53	2.61	2.72	2.83	3.01	3.19	3.36	3.56	3.81
	(per week)	99 63	102.97	107.53	112.34	114.90	122.51	129.51	133.73	142.04	154.69
Agriculture[d,g]	(per hour)	0.88	0.90	0.95	1.03	1.12	1.12	1.33	1.42	1.48	1.58
Non-agricultural sector	(per hour)	2.28	2.36	2.45	2.56	2.68	2.85	3.04	3.22	3.43	3.65
	(per week)	88.46	91.33	95.06	98.82	101.84	107.73	114.61	119.46	126.91	135.78

[a] Includes family allowances and the value of payment in kind.

[b] Includes salaried employees.

[c] Scope of series enlarged starting in 1969.

[d] Wage rates rather than average earnings per worker.

[e] Cash part of remuneration (where received partly in cash and partly in kind) and estimated value of payments in kind for board and lodging.

[f] For building only.

[g] Includes all workers (day laborers and permanent seasonal workers). Wage rate may be complete wage where workers remunerated wholly in cash or cash part where remunerated partly in cash and partly in kind. Excludes Alaska and Hawaii.

Table 3.12b: Wages in manufacturing and construction in some African countries (national currency units) (source: ref. 40)

Country and year		Type of wage	Currency unit	Industry	
				Construction	Manufacturing
Algeria	(1961)	hourly, skilled	franc	1.93	2.07
		hourly, laborer	franc	1.51	1.41
Ghana	(1961)	monthly[a]	shilling	296	371
Kenya	(1959)	monthly[a,b,c], males	shilling	143	141
Malawi	(1962)	monthly[a,b]	pound	5.7	5.7
Nigeria	(1960)	monthly, skilled	pound	12.3	15.4
		monthly, unskilled	pound	6.4	7.4
Rhodesia	(1962)	monthly[a,b]	pound	10.2	11.7
Senegal	(1961)	hourly	franc	74.70	79.50
Tanganyika	(1962)	monthly	shilling	127	136
U.A.R.	(1962)	weekly	piastre	226[d]	219[e]
Zambia	(1962)	monthly[a,b]	pound	10.6	11.8

[a]Including employees.

[b]Including value of payments in kind.

[c]Adults only.

[d]Building only.

[e]Males only.

Table 3.12c: Average wage per employee[a] in construction and manufacturing (source: calculated from Table A2.14)

Country and year		Average wage per employee (thousands of national currency units per person)	
		Construction	Manufacturing
Ethiopia[b] (dollar)	1958	na	0.628
	1961	0.573	na
	1962	na	0.653
	1963	na	0.664
Korea[c] (won)	1968	na	107.1
	1969	120.2	133.4
	1970	170.2	164.1
United States[d] (dollar)	1958	5.020	4.886
	1963	6.018	5.755
	1965	6.595	6.330
	1967	7.417	6.688
	1968	7.953	7.104
	1969	8.615	7.451
	1970	9.293	7.729
	1971	9.909	na

[a] Wages and salaries divided by employees; for these figures see Table A2.14.

[b] Construction data are for licensed enterprises engaged in contract construction. Manufacturing data include establishments with five or more employees except those engaged in flour milling for client's account, coffee and grain cleaning, shoe making, and repairing and tailoring.

[c] Construction data are for all registered units. Manufacturing data are for establishments with five or more persons engaged excluding government establishments other than railroad workshops and tobacco factories.

[d] Construction data include all enterprises engaged in contract construction as of January 1. Manufacturing data are for establishments with at least one employee excluding central administrative offices and auxiliaries serving manufacturing establishments (in 1963 and 1967-70) and excluding those establishments engaged in manufacturing or repairing for the retail trade (in 1958 and 1965).

Table 3.12d: Average wage per employee in Kenya, by industry, 1968 (source: ref. 34)

Industry[a]	Annual wage bill[b] (millions of pounds)	Employment[c] (thousands)	Average wage per employee (pounds per person)
Building and construction	4.6	18.1	254
Manufacturing and repair	18.9	58.2	325
Agriculture and forestry	12.3	173.0	71
Total	147.0	608.7	241

[a]Private employers engaged in industrial, commercial, agricultural, and other activities were asked to state their main activity, and this was the basis of industrial classification.

[b]Estimated from monthly data; reported earnings for the month are multiplied by twelve. Wages cover all cash payments, including basic salary, cost of living allowances, and profit bonuses, together with the value of rations and free board and an estimate of the employer's contribution toward housing. Non-cash benefits, such as retirement benefits and passage assistance, are excluded.

[c]Figures are as of the end of June and include all apprentices, part-time workers, and directors and partners not serving on a basic salary contract.

growing construction wages in the U.S., including (1) factors which influence changes in wage levels in nearly any industry, such as levels of or changes in the unemployment rate, cost of living, productivity, profit rate, and other industries' wage levels; (2) factors for which higher construction wages are supposed to compensate, such as employment instability, low level of fringe benefits, high proportion of skilled labor, and hazardous and often unpleasant working conditions; (3) union influence in the form of work stoppages and union control over the labor supply through hiring halls and training programs; and (4) local market conditions and the decentralized structure of collective bargaining.

In most developing countries, on the other hand, with the exception of Korea, wages in construction are somewhat lower than those in manufacturing but still higher than those in agriculture and the economy as a whole (see Tables 2.5, 3.12, and A3.28). In the early stages of development, moreover, wages in construction tend to grow more slowly than those in manufacturing, although as development progresses and construction's need for labor increases, wages tend to rise faster than in manufacturing and soon exceed them. This appears to have begun to occur in Korea but not in the African countries in general. This wage discrepancy between developed and developing countries is at least partly due to the generally low proportion of skilled labor used in construction and the generally new, if even existent, labor unions in the developing countries. In an effort to make construction a more attractive and permanent occupation in developing countries, it is probably necessary to raise the wages in order to successfully compete for the labor, although at the same time care must be taken to assure that they do not get out of hand as they have in some industrialized countries. Some possible measures in this direction include stabilizing construction demand, improving manpower planning and with it training, allocation, and utilization of labor, and the careful structuring of collective bargaining.

Wage differentials between the low and high skilled occupations in the developing countries are generally relatively larger than in the developed countries (see Table A3.29). At the same time, wages for the less skilled occupations tend to rise faster (see Table A3.30), and in many countries minimum wages have been set and to some extent enforced for unskilled, women, and young workers, while occupations requiring more skill have not always been given similar attention. Broader use of minimum wage laws might be considered as well as systems of sectoral as opposed to national minimum wages.

Another issue related to wages in construction is the industry's general shortcomings in social legislation, such as provisions for social security and various fringe benefits. In many developing countries social legislation in theory is relatively progressive, but in practice is applied only in a few industries, usually not including construction. This problem arises largely because of the temporary nature of work in construction, and it appears that some special arrangements probably need to be made in this area. These might include making benefits arising from health, welfare, and pension funds more transferable, for example, and developing special unemployment compensation programs.

Working and living conditions on the site itself are another topic of significance in construction. The nature and extent of facilities and amenities provided by the employers for the welfare of their workers vary widely with economic factors and different site conditions. Urban and rural projects with workers living at home might provide only the barest necessities, while large projects of long duration in remote locations might build whole towns and labor camps, where living conditions may actually be above the country's standard. Small projects of short duration in remote locations, however, often face serious welfare problems due to the employer's unwillingness to provide the necessary facilities. Since sites vary so greatly, no exact legislation can really be laid down, although welfare facilities to be provided could be specified in the contract documents and perhaps some minimum legal requirements could be set.

Work in construction in both developing and developed countries is often considered unpleasant because it is strenuous, dirty, and exposed to the weather, but of even more consequence is the hazardous nature of such work. Construction's accident ratios are high due to the dangers inherent in the erection of large structures, the temporary nature of the work, and the large number of small firms involved. In addition, in the developing countries, the industry's rapid rate of expansion is not conducive to safety consciousness, there is little safety legislation and even less enforcement, managers and supervisors are often unfamiliar with the few standards that do exist, communication is a common problem with foreign contractors, and there are often a number of firms involved on a single site. It is important to educate the workers with regard to safety, to make and keep managers and supervisors knowledgeable about minimum protective standards, and to establish, update, and enforce adequate safety regulations.

Along somewhat similar lines is the frequent employment of women and children in construction, and the general lack of regulative protective legislation or its enforcement. The age at which children can be recruited and the kind of tasks and hours of work women and children can be expected to do, as well as their wages, must be carefully regulated through enforced legislation. Moreover, particularly in the case of children, it is important to consider what the worker is learning on his job.

Employees' organizations have been mentioned several times in regard to protecting the workers' rights. In industrialized countries unions play an important role in this respect, and in construction they additionally take an active part in training and hiring procedures; unions are also involved in political activities in several European countries. In many developing countries, however, only relatively few construction workers are formally organized, and often the unions that do exist are ineffective. While legislation can be developed to protect the worker, it is often hard to enforce, particularly in construction due to the temporary nature of the work, and the large number of sites. These features along with other conditions peculiar to developing countries such as the poverty and ignorance of many workers, their non-commitment to industrialization, and a shifting work force also complicate union organization. Nevertheless, collective bargaining agreements between employers' and workers' organizations, based on a minimum set of standards concerning the workers' welfare, seem potentially more feasible and successful than simply relying on legislation and its enforcement.

The development of workers' organizations in developing countries requires much thought, for while the developing countries can learn from the industrialized countries in the area of labor-management relations, it is important that they do not simply mimic the current systems because they have many shortcomings and features which are incompatible with conditions in developing countries. An important area of consideration, for example, is whether it is desirable for unions to develop along craft or craft-industrial lines, and whether collective bargaining should develop along craft, geographic area, and industry sector lines as has happened in construction in industrialized countries, or along somewhat broader lines as is happening now in developed countries. It is also important that equally strong employers' associations develop concurrently and, since construction is an especially strike-prone industry in many developed countries (see Table A3.31), that effective dispute-settlement machinery be established.

3.34 Materials: In both developing and developed countries the construction industry is highly dependent upon other industries for inputs to the building process. Materials' share of total construction costs in the U.S. and various developing countries, as shown in Table 2.10, ranges from a low of 17 percent for dredging operations in the U.S. to a high of 70 percent for housebuilding in Kenya, with an average of about 50 percent. A number of factors may account for these variations. Data for Ethiopia and Kenya are limited to housebuilding, and thus one would expect the materials' component to be higher than that for Korea which includes all types of construction, about half of which is civil engineering work. The data in Tables 3.13 and A3.32 show the types and amounts of materials used in construction over the years in the U.S. While these same basic materials are probably used in developing countries, their costs are different (see Table A3.33 and Figure A3.1), and they may be used in different proportions, or local materials may be substituted as the indigenous industry develops. In

Table 3.13: Distribution of material and equipment costs per thousand dollars of contract cost for various types of construction in the U.S. (dollars per $1000 or contract cost) (source: ref. 30, 57, 59, 60).

Material	Private single-family housing[a] (1962)	Federal office building[b] (1959-1960)	Sewer works[c] (1962-1963)	Civil works-land operations[d] (1959-1960)
All materials	482.40	532.50	564.70	542.50
Lumber and wood products	193.20	17.60	6.70	22.50
Rough and dressed lumber	110.10[e]	na	na	10.90
All other lumber products	83.10	na	na	11.60
Stone, clay, and glass products	116.60	117.20	234.60	144.00
Cement, concrete, and gypsum products	76.70	60.80	130.20	48.60
Clay products	19.70	18.50	77.40	95.40[i]
Other stone, clay and glass products	20.20[f]	37.90	27.00	
Metal products (except plumbing and heating)	55.00	133.30	105.70	78.80
Fabricated structural metal products	36.40	102.50	49.70	76.20
Other fabricated metal products		6.90		
Other metal products	18.60	24.00	56.00	2.60
Plumbing products	26.80	27.40	1.10	-
Heating, ventilating, and air conditioning equipment	18.50	65.50	5.20	-
Electrical products (except heating)	17.60	96.90	23.30	1.30
Fixed building equipment	13.70[g]	42.50	69.90[h]	3.20

(continued)

(Table 3.13 continued)

Material	Private single-family housing[a] (1962)	Federal office building[b] (1959-1960)	Sewer works[c] (1962-1963)	Civil works-land operations[d] (1959-1960)
Petroleum products	11.10	4.70	14.00	68.60
Chemicals, including paint	10.30	5.50	3.60	21.00
Explosives	-	-	1.80	19.50
Other chemical products	10.30	5.50	1.80	1.50
Construction equipment (rental charges or depreciation)	9.80	19.10	98.60	192.00
All other	9.80	2.80	2.10	11.10

Note: Detail may not add to totals due to rounding.

[a]Ref. 59.

[b]Ref. 30.

[c]Includes sewer lines and plants, ref. 60.

[d]Includes levees, dams, bank stabilization, pile dikes, local flood protection, and miscellaneous other projects, ref. 57.

[e]Includes data for prefabricated or packaged houses not broken down into separate wood components.

[f]Includes sand, gravel, and dirt fill.

[g]Includes built-in major appliances (refrigerators, dishwashers, ranges, etc.).

[h]Includes sewage plant equipment.

[i]Includes broken and crushed stone, sand, and gravel.

Ethiopia and Kenya expensive imported materials and relatively cheap labor are used, while in the U.S., locally available but largely prefabricated materials are employed and production is largely mechanized. In Korea, which is considerably more developed than are Ethiopia and Kenya, materials have become relatively less expensive as less reliance is placed on imports, while labor has become relatively more expensive as competition has increased. While the development of import-substituting capacity does not generally appear to result in actual materials' costs reductions (41), these costs in both developing and developed countries grow more slowly than do those of labor (see Tables A3.30 and A3.34 and Figure 2.4).

Yet another indicator of the importance of building materials in construction are the man-hours spent in other industries involved in the production and distribution of materials and equipment for construction. In all cases, as shown in Tables 2.12 and 2.13, the other industries' component is even larger than that of the construction industry, and thus the potential for employment in these ancillary industries is greater than in construction itself. These data, however, are for the U.S. only, and it appears probable that in the developing countries the ratio of ancillary man-hours to those in construction is somewhat less because many of the materials, equipment, and supplies are imported and the local goods which are used are generally in a simpler form (e.g., materials less prefabricated and equipment less sophisticated).

The production, consumption, and trade of materials and the wisdom of developing local building materials industries deserve some discussion. Building materials may be divided into two general classes: (1) basic materials, such as cement, iron and steel products, and wood products, and (2) building fittings and fixtures, such as electrical, mechanical, and plumbing equipment. A wide variety of industries therefore are involved in the production of these materials, including woodworking, chemical, metal, and engineering industries.

Per capita consumption of building materials in developing countries is generally far below that in developed countries. In Africa, for example, per capita consumption of cement in the late sixties was only one-tenth of that in developed countries, that of metal products was one-sixtieth, and that of sawn wood was one-twelfth (38). Table A3.35 gives more detailed data for Africa and its subregions relative to the world and further demonstrates the considerable disparity among subregions in per capita consumption levels. A trend, similar to the strong positive correlation between per capita value added in construction and per capita GDP (see Figure 2.1), is apparent for many building materials in that per capita consumption seems to be directly related to per capita GDP or, alternatively, to per capita national income. Figures 3.1 and A3.2 show these relationships for cement. This correspondence between GDP or income and consumption suggests that developing countries have rather low capacities for immediate consumption of many building materials.

In line with these trends in consumption are trends in production. Table 3.14 shows that Europe, North America, and the USSR, for example, were responsible for 72 percent of the world production of cement and 60 to 92 percent of that of wood products in 196´-1967. Figures for steel and iron products production might be expected to be equally high or higher. Consequently, a large part (as much as 60 percent--see Table 2.6) of the relatively meager materials consumption in deve-

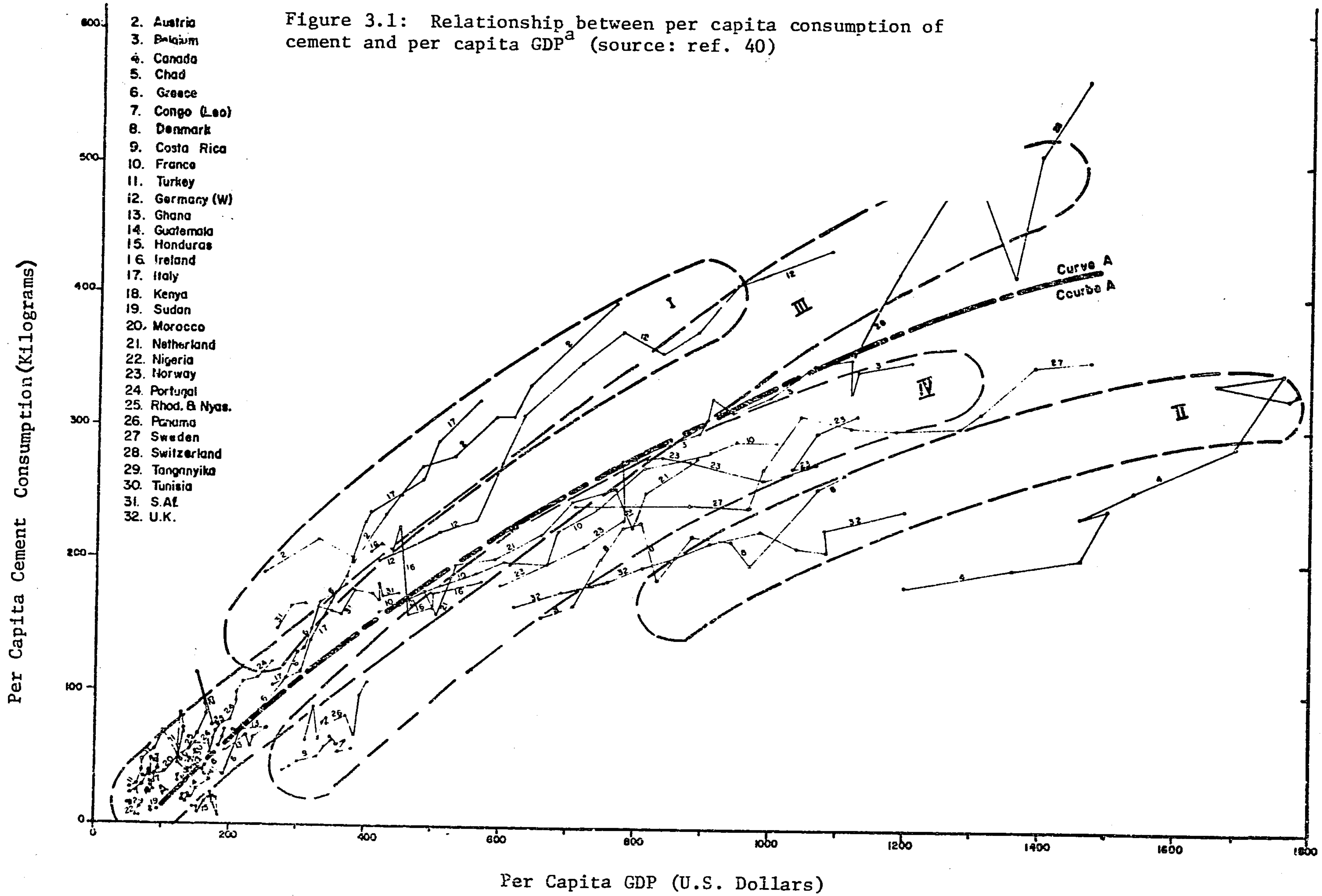

Figure 3.1: Relationship between per capita consumption of cement and per capita GDP[a] (source: ref. 40)

(Figure 3.1 continued)

[a]Data relates to the period 1950-1960. The source, which deals mainly with Africa, describes the figure in the following way: "Four broad areas of correlation can be identified. Area I corresponds to countries with a comparatively high ratio of per capita consumption of cement; area II, on the other side, concerns countries mostly above $600 of per capita GDP and is dominated by the growth pattern of the United Kingdom and Canada where specific consumption of cement is comparatively low in relation to other structural building materials. Neither of these areas is therefore relevant to the situation prevailing in Africa. If areas III and IV are taken jointly, it is possible to discern a general pattern which, for the sake of simplification, has been represented by curve A."

Table 3.14: Percentage of world production of certain building materials by Europe, North America, and USSR in 1966/1967 (source: ref. 47)

Material	Percentage of world production by Europe, North America, and USSR, 1966/1967
Cement	72
Sawn softwood	83
Sawn hardwood	60
Plywood	79
Fibreboard	85
Particle board	92

loping countries is of imported goods. Materials like sand, aggregates, and natural stone, cement and cement products, and wood products are largely produced locally, while materials like glass, iron and steel products, other metal products, and electrical and sanitary equipment are largely imported (see Tables 3.15 and A3.36). Materials which thus have low value to weight ratios, have available the necessary raw materials, have relatively low capital requirements, require relatively unsophisticated production procedures, and are widely used are naturally more likely to be produced locally.

It is also important to consider the magnitude of exports of raw materials and primary products entering in the manufacture of building materials and components. Data in Table 3.16a show the value of exports to be nearly twice that of imports of basic building products indicated in Table 3.16b and about the same as that of imports of all building materials and components indicated in Table 3.15. This makes the import problem seem less serious until one looks at the distribution of imports and exports and notes that the subregions which import the most tend to export the least. Further, these figures are dollar values, and relative quantities are also of importance. In many developing countries, moreover, the value of imported building materials is between 5 and 8 percent of the total value of imports, while expenditure on building materials is only between 3 and 5 percent of GDP (47). This situation suggests that building materials, relative to inputs for other industries, use a disproportionate share of foreign exchange.

Cement is an indispensable ingredient in concrete, a major building material throughout the world. Many of the special problems of cement manufacture in developing regions result from the generally re-

Table 3.15: Building materials produced or imported for local consumption in Africa[a], around 1960 (source: ref. 40)

Material	Domestic production consumed locally	Imports	Total domestic consumption	Imports as a percentage of total domestic consumption
	(billions of dollars)			(percentage)
Cement	0.12	0.06	0.18	33.3
Cement products	0.06[b]	0.01	0.07	14.3
Bricks, tiles, and other ceramic products	0.01[b]	0.01	0.02	50.0
Iron and steel products	0.04	0.30	0.34	88.2
Other metal products	0.02[b]	0.08[b]	0.10	80.0
Wood products	0.12[b]	0.06	0.18	33.3
Glass	-	0.01	0.01	100.0
Paints and varnishes	0.02[b]	0.03	0.05	60.0
Electrical and sanitary equipment	0.04[b]	0.16[b]	0.20	80.0
Sand, aggregates, natural stone, and other bulk materials	0.10[b]	-	0.10	0.0
Total	0.53	0.72	1.25	57.6

[a]Excluding Southern Africa.

[b]Estimated.

Table 3.16a: Exports of raw materials and primary products entering in the manufacture of building materials, for Africa by subregions, 1960 (millions of dollars) (source: ref. 40)

Material	North Africa	West Africa	Central Africa	East Africa[a]	Total	Percentage distribution by material
Cement	8	-	-	3	11	1
Metallic mineral ores	66	73	19	17	175	21
Primary metal products	7	9	111	353	480	58
Round wood	-	71	47	-	118	14
Sawnwood, veneers, and plywood	-	25	16	4	45	6
Total	81	178	193	377	829	100
Percentage distribution by subregion	10	21	23	45	100	

Note: Detail may not add to totals due to rounding.

[a]Including Madagascar.

Table 3.16b: Imports of main building materials and components, for Africa by subregions, 1960 (source: ref. 40)

Material		North Africa	West Africa	Central Africa	East Africa	Madagascar	Total
Cement	(million dollars)	10	36	4	4	2	56
	(percentage)	18	64	7	7	4	100
Other fabricated building materials							
	(million dollars)	3	6	-	2	-	11
	(percentage)	25	59	-	16	-	100
Bricks, tiles, and ceramic wares							
	(million dollars)	6	3	-	3	-	13
	(percentage)	49	21	2	26	2	100
Iron and steel products							
	(million dollars)	131	94	18	50	6	299
	(percentage)	44	32	6	16	2	100
Sawnwood, veneers, and plywood							
	(million dollars)	52	3	-	8	-	63
	(percentage)	82	4	1	12	1	100
Glass and manufactures							
	(million dollars)	5	2	-	2	-	10
	(percentage)	53	24	3	17	3	100
Paints and vanishes							
	(million dollars)	12	10	2	4	1	29
	(percentage)	41	34	6	15	4	100
Total	(million dollars)	219	154	24	73	9	481
	(percentage)	46	32	5	15	2	100
Imports of main building materials and components as a percentage of total imports (average 1959-1961)		8	10	6	8	8	8

duced scale of production and consumption in these areas. The data on cement production and apparent consumption in Table 3.17 show tremendous disparity between conditions in the U.S., the world as a whole, and the developing countries. Nevertheless, the general trend is growth of cement production and consumption, generally at a faster rate in the developing countries, especially those of Asia, than in the U.S. and the world as a whole.

There have recently been shortages in the international supply of cement and delays in the delivery of plants, but the developing countries still appear to be progressing fairly well in this area. In Latin America it appears that in most countries the import substitution process regarding cement has been completed (35). In 1967 in Colombia, for example, there were 14 cement plants with a total capacity of 3.0 million tons (48), and the total apparent consumption for that year was 2.3 million tons (see Table 3.17b). Raw materials for production of cement are available in Asia and the Far East, and production has been climbing, particularly with Korea, Malaysia, Thailand, and South Vietnam building new factories and even beginning to look for export outlets. Their production is still generally behind consumption, however (35). The present installed capacity in Africa is more than adequate to cover the aggregate consumption, but Africa still continues to import substantial quantities of cement (35). The data in Table 3.18 show that in 1962 African production as a whole utilized only 66 percent of domestic consumption. One encouraging sign is the relatively rapid growth of exports. Kenya and Ethiopia are both apparently exceptions to these trends. In Kenya in 1962 production utilized only 66 percent of capacity, imports were practically negligible, and exports high. In Ethio-

Table 3.17a: Total and per capita cement production for the world, some developing areas, and the U.S. (source: ref. 54,55)

Year	World	Africa[a]	Asia[b]	Latin America	United States
1953					
Total production (10^6 kg)	177,000	2,878	12,232	10,439	45,001
% of world production	100.0	1.6	6.9	5.9	25.4
Per capita production (kg)			not available		
1960					
Total production (10^6 kg)	317,000	6,295	35,463	17,599	56,063
% of world production	100.0	2.0	11.2	5.6	17.7
Per capita production (kg)	106.3	24.8	22.8	82.6	309.7
1964					
Total production (10^6 kg)	410,000	6,544	39,105	22,502	64,379
% of world production	100.0	1.6	9.5	5.5	15.7
Per capita production (kg)	127.3	22.6	23.2	94.9	335.3
1968					
Total production (10^6 kg)	506,000	9,590	53,323	29,975	68,792
% of world production	100.0	1.9	10.5	5.9	13.6
Per capita production (kg)	145.27	30.3	28.9	112.3	342.2
1970					
Total production (10^6 kg)	567,000	10,248	66,811	33,298	67,427
% of world production	100.0	1.8	11.8	5.9	11.9
Per capita production (kg)	156.1	31.7	34.2	117.7	328.9

[a]Excluding South Africa.

[b]Excluding Japan and the USSR.

Table 3.17b: Per capita apparent consumption of cement in Colombia, Ethiopia, Iran, Kenya, Korea, and the U.S., for 1963-1970 (source: ref. 54, 55, 61)

Country and year		Production	Imports	Exports	Apparent consumption	Per capita apparent consumption
		(thousand kilograms)				(kilograms per person)
Colombia	1970	2,774,000	704,000	248,671	3,229,329	153
	1969	2,383,000	351,000	278,185	2,458,815	120
	1968	2,367,000	307,000	328,763	2,345,237	118
	1967	2,146,000	202,000	229,955	2,118,045	110
	1966	2,107,000	435,000	181,325	2,360,675	127
	1965	2,074,000	703,000	189,136	2,587,864	143
	1964	1,995,000	309,000	185,733	2,118,267	121
	1963	1,838,000	566,000	122,347	2,281,653	135
Ethiopia[a]	1969	174,000	804	22,621	152,183	6.1
	1968	164,000	1,876	22,692	143,184	6.0
	1967	138,000	2,709[b]	na	na	na
	1966	89,000	6,204[b]	na	na	na
	1965	73,000	28,120[b]	na	na	na
	1964	34,000	25,011[b]	na	na	na
	1963	44,000	39,125	na	na	na
Iran	1970	2,575,000	54,513	96,991	2,532,522	88
	1969	2,342,000	22,837	34,353	2,330,484	84

(continued)

(Table 3.17b continued)

Country and year		Production	Imports	Exports	Apparent consumption	Per capita apparent consumption
		(thousand kilograms)				(kilograms) per person)
(Iran, cont.)	1968	2,000,000	51,132	42,903	2,008,229	74
	1967	1,517,000	40,000	54,593	1,502,407	65
	1966	1,538,000[c]	16,000	92,598	1,461,402	64
	1965	1,417,000	20,000	128,509	1,308,491	53
	1964	1,088,000	24,000	101,410	1,010,590	44
	1963	787,000	23,000	63,396	746,604	32
Kenya	1970	792,000	986	348,575	444,411	41
	1969	642,000	1,215	309,041	334,174	32
	1968	544,000	1,265	239,039	306,226	30
	1967	493,000	834	221,189	272,645	27
	1966	470,000	611	169,534	301,077	31
	1965	484,000	175	199,415	284,760	30
	1964	422,000	1,318	174,124	249,194	27
	1963	344,000	771	110,607	234,164	26
Korea	1970	5,822,000	967	450,865	5,372,102	169
	1969	4,828,000	15,727	290,970	4,552,757	146
	1968	3,572,000	142,000	17,500	3,696,500	121
	1967	2,441,000	467,745	5,315	2,903,430	97

(continued)

(Table 3.17b continued)

Country and year		Production	Imports	Exports	Apparent consumption	Per capita apparent consumption
		(thousand kilograms)				(kilograms per person)
(Korea, cont.)	1966	1,884,000	177,615	24,704	2,033,911	70
	1965	1,641,000	6,069	54,884	1,592,185	53
	1964	1,243,000	28,237	21,273	1,249,514	45
	1963	778,000	274,294	—	1,052,294	39
United States	1970	67,427,000	2,348	144	67,429,204	328
	1969	69,575,000	1,647	100	69,576,547	342
	1968	68,792,000	1,239	160	68,793,079	342
	1967	64,449,000	1,005	167	64,449,838	324
	1966	67,146,000	1,201	182	67,147,019	342
	1965	65,078,000	936	127	65,078,809	334
	1964	64,379,000	618	121	64,379,497	335
	1963	61,609,000	685	78	61,609,607	326

[a]Production figures are for twelve months ending September 10 of the year stated.

[b]Lime, cement, and other construction materials.

[c]Excluding natural cement.

Table 3.18: Production, trade, and consumption of cement for Africa's subregions, 1958-1962 (thousand metric tons) (source: ref. 40)

		North Africa	West Africa	Central Africa	East Africa			Madagascar	Total
					Kenya	Ethiopia	Total		
Production	1952	2,076	80	240	33	10	291	-	2,687
	1958	3,197	262	390	240	32	1,174	8	5,031
	1960	3,990	320	200	342	28	1,042	18	5,570
	1962	4,106	610	162	342	41	838	17	5,733
Annual rate of growth[a] (percentage)		7.1	22.5	-	26.3	15.2	11.6	20.7[b]	7.9
Installed capacity[c]		5,230	880	735	520	36[d]	1,706	70	8,620
Production capacity[c] (percent)		79	69	22	66	100	49	24	66
Imports	1958	423	1,147	273	8	8	183	80	2,106
	1960	717	1,624	144	1	35	201	84	2,770
	1962	847	1,369	193	1	(30)	212	104	2,725
Exports	1958	451	-	-	68	-	89	-	540
	1960	628	-	-	158	-	164	-	792
	1962	(607)	-	-	(233)	-	234	-	841
Consumption[e]	1958	3,202	1,406	663	175	40	1,260	88	6,619
	1960	4,129	1,882	344	186	63	1,077	102	7,534
	1962	4,346	1,979	355	110	71	816	121	7,617

[a] Unless otherwise specified, 1952 - 1962.

[b] Annual rate of growth, 1958-1962.

[c] Unless otherwise stated, for 1962.

[d] 1961.

[e] Consumption is not necessarily the arithmetic result of the data under production, imports, and exports due to discrepancies in the reporting of annual statistics.

pia, on the other hand, production fully utilized the available capacity, imports were high, and exports negligible. Kenya thus appears to need to increase its export industry and Ethiopia its capacity, although a possible solution would be arrangements for regional cooperation and trade between the two countries.

Steel production not only is a symbol of participation in modern technology, but is also a kno n accelerator of many areas of economic growth. If one considers the first three items and a part of the fourth in Table 3.19 to be primarily building materials, then 45 to 50 percent of the steel consumed in developing regions goes to construction. The growth of steel consumption and especially of production in Asia from 1953 to 1965 was particularly high; as a result, in 1965 Asia was only slightly behind Latin America in the share of regional consumption covered by regional production, while Africa was far behind (see Tables 3.20 and A3.37). At the same time, however, the first integrated steel plants in Iran and Korea were not due for completion until some time between 1966 and 1975, while Colombia has been expanding its capacity and both Kenya and Ethiopia were at least noted as producing some iron and steel products in 1960 (26, 37). It is of further interest to note the strong tie between consumption and production in that per capita steel consumption in steel-producing developing countries is much higher than in developing countries which do not produce steel (see Table A3.38).

The manufacture of wood and wood products is a supply-based industry relying on the extraction and improvement of natural resources. Wood is one of the plentiful resources of most developing regions (see Table 3.21), and virtually all developing countries with the exception of the arid Middle East possess sufficient forest resources to meet all

Table 3.19: Pattern of consumption of steel products in developing regions[a] (source: ref. 29)

Steel product	Percent of total steel consumption
Reinforcing rods	30
Light structural sections	7
Galvanized sheets	5
Pipes and tubes	12
Rounds	10
Wire	10
Sheets and plates	12
Tinplate	7
Miscellaneous - primarily rails	7

[a]No date given, original source is copyright 1963.

Table 3.20: Steel production and consumption in developing areas, 1953-1965 (source: ref. 26)

	Africa	Asia	Latin America	Total
Growth of apparent consumption (compound rate -- percent per annum, 1953-1965)	5.45	7.48	7.20	7.14
Growth of local production (compound rate - percent per annum, 1953-1965)	10.03	15.08	12.35	13.55
Percentage of regional steel consumption covered by regional production				
1953	5	23	38	27
1960	10	43	56	45
1965	9	52	68	53

Table 3.21: Wood resources in various developed and developing countries, 1963 (source: ref. 29)

Country	Forest area (thousand hectares)	Per capita forest area (hectares)	Annual harvestable wood per capita (cubic feet[a])
U. S.	292,721	1.48	222
France	11,000	0.22	53
U. K.	1,675	0.03	4
Guatemala	4,100	0.89	133
Mexico	39,747	0.91	139
Nicaragua	6,450	3.80	550
Brazil	335,100	4.00	600
Peru	65,300	5.40	810
Angola	72,000	13.80	2,060
Congo	129,141	7.95	1,190
Ivory Coast	12,000	3.05	456
Sierra Leona	2,300	0.99	144
Uganda	9,167	1.18	176
Burma	45,274	1.80	268
Laos	15,000	7.40	1,110

[a]Approximation based on annual harvestable growth of 750 cubic feet per hectare (300 cubic feet per acre) every five years.

domestic demand in the foreseeable future. Nevertheless, these resources are remarkably underutilized as indicated by the figures in Table 3.22. Since consumption of wood and wood products generally exceeds production in developing countries, these materials usually are imported from the developed countries which, paradoxically, are relatively poorer in forest resources. Sawnwood in Africa is a case in point, and although production and consumption are more balanced in the case of plywood and veneers, production of these goods in Africa is largely limited to a few countries (see Table A3.39). A partial explanation of this arrangement is that many developing countries export large parts of their annual wood harvest in the form of rough logs, which are turned into manufactured wood products in the developed countries and then returned to the developing nations. The low share of sawnwood in total roundwood production, as shown for Africa in Table A3.40, tends to support this hypothesis. The wisdom of such an arrangement appears highly questionable.

The extensive use of imports in the supply of building materials to the construction industry in developing countries has been repeatedly emphasized throughout the above discussion. Some of the obvious disadvantages of such reliance on imports include the facts that (1) materials are costly, (2) large amounts of foreign exchange are used, (3) consumption levels of building materials tend to be low, and (4) materials may be incompatible with local conditions. Furthermore, large quantities of natural resources are left untapped, and the advantages to be gained from the development of local manufacturing industries, such as providing employment and training, helping in income re-distribution, generating output, and stimulating further industrial and economic growth, are lost.

Table 3.22: Annual wood building materials manufacture in various developed and developing countries, 1966 (source: ref. 29)

Country	Sawnwood	Sleepers	Veneer sheets	Plywood	Particle board	Total wood building materials (thousands of cubic meters)	Total wood building materials (cubic meters per capita)	Total wood building materials (cubic feet per capita)	Percent of annual harvestable wood used in wood building materials manufacture
	(thousands of cubic meters)								
U.S.	85,982[a]	–[a]	na	13,014	2,079	101,075	0.51	18.0	8.1
France	8,243	382	71	494	727	9,917	0.20	7.0	13.1
U.K.	856	6	na	38	288	1,188	0.022	0.7	191.0
Guatemala	164[b]	2[c]	na	6[c]	10[c]	182	0.039	1.4	1.05
Mexico	1,384	164	0.3	69	36	1,653	0.037	1.3	0.94
Nicaragua	128	3	na	7	–	138	0.08	2.8	0.51
Brazil	6,072	480	198	220	9	6,979	0.083	2.9	0.48
Peru[b]	224	12	–	7	4	247	0.02	0.7	0.86
Angola[c]	95	–	–	–	–	95	0.018	0.6	0.03
Congo[d]	150	–	40	15	–	205	0.013	0.4	0.04
Ivory Coast	285	–	35	8	–	328	0.084	2.9	0.64
Sierra Leone[e]	10	–	–	–	–	10	0.004	0.1	0.97
Uganda	51	5	–	3	–	59	0.008	0.3	0.15
Burma	594	15	0.1	3	–	612	0.025	0.9	0.32
Laos	33	–	–	–	–	33	0.016	0.6	0.05

[a]Sleepers included in sawnwood.

[b]Data is for 1964.

[c]Data is for 1965.

[d]Democratic Republic of Congo.

[e]Twelve months engine June 30, 1966.

The establishment of basic building materials manufacture in developing countries will depend on both economic and technical considerations. The first step in establishing a building materials plant is to perform a pre-investment survey and market study. The existing building skills also must be assessed before the suitability of introducing any building material can be judged, and regional customs and practices relating to building must be considered. In East Africa, for example, building contractors commonly manufacture their own materials (e.g., cement blocks) on the site, and the introduction of a building material economically produceable on a small scale would thus be far more likely to win acceptance. The geographic extent of the market is important and depends partly upon the size, weight, and usual required quantity of any given building material and upon the ability of the available transport infrastructure to move these goods at reasonable cost (Table A3.41 shows the level of development of highway transport in the U.S. and some developing countries). Local, regional, and even international markets should be considered for some materials, or perhaps regional cooperation might be possible in the production of those materials requiring large markets.

The capital expenditures necessary to establish various building materials manufacture vary from a very small amount for bricks to several million dollars for steel (see Table 3.23). This diversity of minimum capital costs and economic scales of production suggests that a developing nation might, for example, establish a moderate to large capacity cement plant while relying on imported steel to supply the necessary reinforcing rods and mesh; alternatively, it might decide to rely on its production of bricks and wood products for building mate-

Table 3.23: Minimum capital costs and economic scales of production for building materials manufacture[a] (source: ref. 29)

Building material (by type of plant)	Capital cost (dollars per ton per year)	Minimum economic plant size (tons per year)	Capital cost for minimum economic plant (dollars)
Bricks	Variable	Variable	Variable
Wood			
Sawnwood	30	Variable	Variable
Plywood	96	5,000	500,000
Softboard	123	5,000	600,000
Hardboard	96	5,000	500,000
Particle board	55	5,000	275,000
Lime			
Small unmechanized vertical kiln	13.6	30,000	410,000
Large mechanized vertical kiln	14.6 to 18.7	30,000	440,000 to 560,000
Rotary kiln	22.8 to 28.4	30,000	680,000 to 850,000
Cement			
Vertical kiln	28	30,000	880,000
Rotary kiln	40 to 50	100,000	4,000,000 to 5,000,000
Aluminum	800 to 900	10,000	8,000,000 to 9,000,000
Steel	250	100,000	25,000,000

[a]Date of original source is 1968 for bricks and lime and 1963 for all other building materials, and data are from a variety of developed and developing countries.

rials since these are most readily adaptable to small scale production and require virtually no capital investment. It should also be noted that the existing infrastructure can have considerable influence on the initial capital costs; for example, without available electrical power, a steel mill is forced to provide its own power stations, and for a low to medium volume cement plant, this added cost may make the entire operation prohibitively expensive.

The costs of production are another important set of factors to consider in the establishment of building materials manufacture. These costs are directly related to the costs of labor, materials, production supplies, maintenance, and overhead. These factors, in turn, are influenced by the availability, accessability, and quality of appropriate raw materials, labor, and production supplies in the needed quantities; the type, location, and size of the plant; the labor/capital ratios; the level of technical competence required; and so forth. The adaptability of building materials manufacture to labor-intensive methods, while preserving overall efficiency, is of special concern to developing nations. One rough indicator of labor/capital ratios for various building materials is the percentage of output accounted for by value added (see Table 2.7). Table 3.24 gives wage levels and proportion of skilled workers to total employment in certain building materials industries in India. If these figures are relatively typical for developing countries, it appears that labor costs of production are directly related to the capital costs necessary to establish production. The same can probably also be said about the other operating costs, and the total costs of various materials manufacture (capital plus operating costs) thus tend to parallel the disparity of capital costs.

Table 3.24: Labor costs and proportions in building materials manufacture in India[a] (source: ref.29)

Building material	Average daily wage (dollars)		Ratio of skilled workers to total employment (R_s)	Weighted labor cost (dollars) $W_s R_s + W_u (1 - R_s)$
	Skilled (W_s)	Unskilled (W_u)		
Bricks, tiles, lime	0.51	0.26	0.284	0.330
Plywood	0.71	0.16	0.384	0.372
Asbestos products	0.56	0.325	0.444	0.429
Sawmilling	0.56	0.345	0.412	0.432
Cement pipes	0.86	0.33	0.262	0.469
Secondary nonferrous metal products	0.58	0.35	0.570	0.481
Secondary steel products	0.65	0.36	0.480	0.499
Cement	0.76	0.325	0.433	0.514
Primary nonferrous metal products	0.78	0.375	0.499	0.578
Primary steel products	0.82	0.39	0.529	0.618

[a]Original source is dated 1970.

The primary economic benefits to be gained from the development of building materials manufacture, which include increased employment and training, improved income distrubution, output generation, and improved balance of payments, among others, are of considerable importance. Also of importance are the possible secondary economic effects arising out of the diversity of uses for various building materials. The low capital and labor costs of wood products, coupled with the possible secondary manufacturing operations (e.g., furniture and match-making), make this a natural area of growth for developing countries with underutilized forest resources. The high capital and labor costs of primary steel production are compensated for, in a macroeconomic sense, by the economic benefits resulting from the subsequent secondary manufacturing of the steel produced. Cement, on the other hand, has virtually no uses outside the field of construction, but since it is the universal construction material, the secondary effects of cement manufacture within the field of construction (e.g., concrete and cement blocks, pipes, and prefabricated panels) are likely to be considerable.

As for materials technology in developing countries, efforts are being made to develop cheap, serviceable, adaptable, and easily assembled building materials made of locally available raw materials. This development is currently grouped around two basic approaches, one aimed at the improvement of traditional building materials and methods and a second aimed at the development of new materials and components. In line with the first approach, a large part of building materials research in developing countries is devoted to extending the uses of cement, improving the properties and performance of concrete, and developing the uses of plastics in building. Some current research areas include building blocks made of soil cements, lightweight concretes using various agricultural wastes as the aggregate, concrete suitable for tropical climates, reinforceme for concrete in the form of steel suitable to tropical climates or bamboo or other harvestable plants available locally, impregnation of wood and fiber products to improve their permanancy, and plastics in the form of waterproofing of wood and fiber panels, plastic pipes, and emulsion paints based on polyvinyl acetate.

Where construction activity or needs are of sufficiently large scale, preplanned building systems can offer significant economies of both time and money. Developing regions have similar needs in the types of buildings required, and at least for housing, one and two-story construction are most common (see Table A3.42). This prevalence of one and two-story construction around the world has led to widespread interest in the use of lightweight structural panels, among which the most promising are those made of wood and ferro-cements. In the development of building materials and building systems in emerging countries, it is important that materials not be limited to those in standard use in the industrialized countries; innovative consideration also must be given to the use of some of the locally abundant raw materials, such as rice straw, bagasse, and bamboo.

3.4 Maintenance

Once construction has been completed the facility's life as a valuable asset begins, but operational and maintenance costs remain. A considerable part of construction activity is, in fact, devoted to maintaining, repairing, altering, or converting existing facilities. The data in Table 2.8 show maintenance and repair as nearly 34 percent of all construction activity in a typical Western European country, although the proportion varies considerably among different sectors. In developing countries maintenance and repair consists of somewhat less than 14 percent of all construction activity; again, the percentages vary among sectors, with maintenance and repair's proportion particularly high in the transport, communications, roads, and other public services sector. While the majority of new construction in developing countries is done by the private sector, the majority of maintenance and repair is done by the public sector. The data for developing countries, however, does not include work in the subsistence sector which is estimated at 10 to 30 percent of the total output, much of which would be in maintenance and repair (48).

Several factors appear responsible for the lighter allocation of construction resources to maintenance and repair in developing than in developed countries. These include the facts that (1) existing facilities are fewer in number and generally newer; (2) lower maintenance standards are usually tolerated; (3) the uncertainty associated with future funding leads to requesting and immediately spending the maximum amount possible, resulting in overdesigned facilities and a neglect of maintenance; (4) low prestige is associated with maintenance, and administrators receive little reward from pursuing efficient maintenance policies; and (5) since there is little emphasis on the importance of maintenance, the major share of scarce manpower, materials, and capital resources goes to new work and the residual to maintenance and repair.

Building and civil engineering maintenance are quite distinct operations. Building maintenance, as opposed to new construction of buildings, tends to require more manpower and less materials and capital;

it is a highly labor-intensive operation in both developing and developed countries, although the labor it requires is fairly skilled. In industrialized countries small firms are largely responsible for maintenance and repair work. In developing countries building maintenance is generally handled by self-employed artisans and thus demands a reasonably large portion of the limited supply of skilled workers. The solution, however, is not to skimp on building maintenance, but rather to educate clients and train skilled workers so the needed maintenance can and will be performed.

The maintenance of civil engineering works in industrialized countries tends to follow the resource requirements of new construction and is generally a rather mechanized process. This is not the case in developing countries, however, where civil engineering maintenance is labor-intensive, requires large masses of unskilled labor, and necessitates particularly effective supervision, organization, and management. The limiting factor is thus the availability of suitably trained management and supervisory personnel. Whether civil engineering maintenance should be labor- or capital-intensive is subject to question. Some cost figures on various operations in road maintenance suggest that capital-intensive techniques are cheapest and labor-intensive most costly, with a balanced approach falling in between (see Table A3.43). While these figures and the scarcity of management personnel point toward capital-intensive techniques, the scarcity of capital, foreign exchange, and skilled labor and the abundance of unskilled labor point toward the labor-intensive or balanced approach. It is thus the overall combination of local and project conditions upon which the optimal choice of technology must depend, and the stock of resources must be adjusted accordingly.

Closely associated with maintenance is the staging of construction, a process whereby a facility is built initially to meet the immediate demands of the user and is then upgraded through reconstruction to meet increased demands. This may result in reduced cost and in more effective use of resources, and it provides a measure of adaptability to the project in case demand for the facility should change. In addition, the possibility of using labor-intensive technologies in such staged construction is considerable. For these reasons it is important that construction technologies suitable for staged construction be identified and considered for use by the developing nations.

3.5 Construction Industry's Environment

The regulatory environment within which the construction industry operates in developed countries is extensive and includes building and related codes, zoning ordinances, subdivision regulations, planning laws, licensing requirements, environmental regulations, safety legislation, monetary and fiscal policies, tax laws, financial institution operating rules, and wage regulations. Similar regulations are emerging in developing countries and need to be expanded, but this must be done with regard for the local conditions of the particualr country, and regulations must not simply be transferred intact from the industrialized nations, as has often occurred in the past.

Some of these industry regulations have already been discussed in some detail, and in this section attention will focus on building and related codes. In many developed countries these regulations have concentrated on setting the materials and methods to be used rather than the desired performance characteristics, thus stifling innovations and adding to construction costs. In the U.S. and elsewhere efforts are now being made to change these to more performance based codes, but progress has been slow, and many developing countries have already adopted materials and methods codes. An advantage of this type of code over the performance based one in the early stages of development of the construction industry is that it requires less in the way of engineering and construction skills on the part of the designer and contractor, although performance codes may be best in the long run.

Building codes in the U.S. are highly fragmented and often outdated. By and large each local area has its own particular code, although more states are now beginning to adopt state-wide codes, and regional and national model codes do exist. If an innovation is to achieve widespread use it must thus satisfy the requirements of many codes and be accepted by each separately, and designers and contractors must be familiar with a variety of codes depending upon the range of their operations. Modification of the codes is dominated by a small group of building code officials and officials of the trade associations in the building materials industry, thereby leaving out many other legitimately interested people. This is less true of Europe, where the countries are smaller and uniform codes, established and kept up to date by national governmental agencies, are in use in some countries. In the developing countires such fragmentation is also less likely to be a problem, although where most work is done by expatriates the firm doing the work essentially may bring in its own country's building codes. While the U.S. has no standard procedure for certifying innovations, France, the British Isles, and many other Western European countries have established the Agrément system whereby a commission of impartial experts test and, if satisfied, certify new materials, methods, and equipment for use in construction.

Developing countries can and should consider these various codes, systems, and practices and adopt, with the necessary modifications, those features most appropriate to the country's local conditions. The development of building codes requires considerable technical competence and might best be done through some sort of national governmental agency. Regional co-operation might also be appropriate for some countries, as might assistance from international agencies and the developed countries.

Closely associated with the development of building codes is the standardization of commonly used building materials in terms of dimensions, quality, composition, performance, and methods of manufacture and testing. In the industrialized countries, this has largely been done at the national level, although it would be highly useful if some such standards could be established at the regional or international level. The standardization of the functional requirements imposed on certain types of buildings and the development of typified or model designs for certain types of buildings might also be useful, both for simplifying the design process and for opening the way to industrialization of building. The developing countries have an opportunity to evolve and apply a coherent national system of standards as well as methods of testing and quality control, and international, or at least regional, unification of standardization and standards is also of considerable importance and merits consideration.

Research, development, and technical information are important in the growth of the construction industry in developing countries. While institutes and agencies exist in the U.S. for the purpose of establishing standards and methods of testing, there are few such centralized organizations for the performance of research and dissemination of information pertaining to construction. Such centralized agencies are much more common in Europe. It is generally felt that technological innovations in construction materials, processes, and equipment have been occurring at a rapid rate in the U.S., but the research has largely been done by a few individuals who lack a sufficiently broad-based focal point, and the results have not been truly innovative. Research also is needed in the area of managerial and organizational aspects of construction.

In developing countries these difficulties are compounded by the youth of the industry. It is thus imperative that the developing countries establish some sort of centralized agencies or institutes, probably supported by the government, along the lines of those in Europe. The responsibilities of these institutes might include (1) encouraging and helping to support research done by others; (2) performing their own research; (3) collecting, digesting, evaluating, and disseminating information on what is occurring in other countries and the results of research in the developing country itself; and (4) developing or helping to develop building standards, methods of testing, and perhaps typified designs.

As for the research itself, any technical or organizational changes which seem likely to lead to the improvement of industry operations should be investigated in the light of local conditions. This might simply involve the development of new and improved techniques requiring less skilled labor than traditional building and resulting in more efficient use of already available tools and equipment such as development of processes which can be broken down into simple operations and general rationalization of work on the site. Alternatively, if local conditions in the country and the industry deem it appropriate, greater industrialization of construction operations such as off-site prefabrication and increased mechanization might be investigated. In the U.S. and other developed countries the acceptance and use of technological innovations by the industry has been slow due to a wide variety of constraining factors, including lack of a formal certification procedure, limited diffusion of information, tradition, building code and zoning problems, production and marketing difficulties, limited capital investment, resistence of labor, and factors relating to industry structure. Similar constraints may be encountered in the developing countries, and means to alleviate them in both developed and developing countries require further investigation.

CHAPTER 4

MULTI-NATIONAL FIRMS IN CONSTRUCTION*

Multi-national firms in the construction industry are those firms concerned with planning, consulting, design, construction, or any combination of these activities on an international level.** These firms must be distinguished from "multi-national corporations" like Exxon or IBM. Construction firms are predominantly concerned with the export of goods and services to foreign contries; they rarely, if ever, engage in direct investment abroad, an important activity of the "multi-national corporation," and thus can have no short-term adverse effect on the balance of payments of the home country. In addition, there is no possible "export of jobs" by this industry, a frequent complaint against "multi-national corporations," since by working abroad multi-national construction firms actually create jobs for people in their home countries.

This chapter begins with a brief overview of the nature and organization of multi-national firms in construction and the character of their present operations in developing countries, and then considers their potential role and the means of implementing it. The purpose of this chapter is simply to point out some of the pertinent issues related to multi-nationals in construction in developing countries, so the discussion is rather preliminary and attention focuses primarily on multinationals concerned with actual construction. Since relatively little

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*Much of this chapter is based on research performed by Frederic S. Mishkin, a graduate student in the Economics Department, Massachusetts Institute of Technology, Cambridge, Massachusetts.

**Some of the larger multi-national contractors in the U.S. include research has been done on these firms and data appears rather scarce, contacting some of the multi-national firms, international agencies, and developing countries involved is probably a necessary part of any further study in this area.

4.1 Nature and Organization of Multi-Nationals and Their Role in Construction in Developing Countries

The size of the construction market served by multi-national firms in developing countries can only be roughly estimated due to the scarcity, poor quality, and limited comparability of data. The construction market in the developing market economies of the world around 1967 was about 25 billion dollars, about 6 billion dollars of which was executed by multi-national construction firms (see Table A4.1). This figure seems reasonably compatible with the data on the size of overseas contracts executed by construction firms of the various industrialized nations, including work undertaken in both developed and developing countries. For example, overseas construction contracts of firms in the U.S. (those in the ENR 400--see ref. [6]), U.K., France, and Italy amounted to about 6.6 billion bollars in 1969. Unfortunately, similar figures for various professional services are not available, but they may be expected to be

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Fluor Corporation, Bechtel, Brown & Root, Inc., The Lummus Company, and The Ralph M. Parsons Company (see ENR 400 [6] for others). Some of the U.S.-based multi-national design firms are Gilbert/Commonwealth Cos., Sargent and Lundy, Dames and Moore, Charles T. Main, Inc., and Black and Veatch (see ENR 500 [7] for others). British firms include Richard Costain Ltd., George Wimpey, and Taylor Woodrow; French, SPIE-Batignoles and Compagnie de Constructions Internationales; German, Hochtief; Italian, Impregilo (a permanent consortium of three Italian contractors) and Imprese Astaldi Estero; and Yugoslav, Energoprojekt. The largest consulting engineering firm in Europe is the Swedish Aktieboleget Vertenbyggnudsbyran. The "big five" multi-national construction firms in Japan are Kajima Corporation, Taisei Construction Company, Tajenaka Komuten Company, Ohbayashi-Gumi, and Shimazu. In Taiwan is the Ret-Ser Engineering Agency, a multi-national contractor, and in Korea, Hyundai.

considerable since such expertise is largely lacking in the developing countries and takes longer to develop than does construction capability.

Multi-national firms generally engage in projects and activities that are beyond the abilities of the local industry. Types of construction generally include infrastructural projects, such as transport, communications, and utilities, where the client is usually the government; and industrial plants, where the client may be the government, an international company headquartered in the U.S. or Europe, or a combination of both, but rarely a private local firm. Occasionally multi-national firms may also construct hotels and office buildings for the international firms or housing for the government. Data in Table A2.10a for Korea suggest that multi-national construction is about evenly split between civil engineering works and building, primarily industrial plant, and this is probably the case in most developing countries although the less developed ones may tend to emphasize public works.

Professional services rendered by multi-nationals include feasibility studies, planning, design, supervision and management of construction, and economic development planning, again for the same clients. Occasionally multi-nationals may do both design and construction, although such design-construct firms or even design-construct teams encounter some difficulty if the project is financed through international sources, many of which require international competitive bidding which generally necessitates separate design and construction contracts and may require that the design and construction firms be separate entities.

Such clients, project types, and services are needed by the multinationals since projects must be large in order to be profitable. For example, a U.S. consulting firm which does some 75 percent of its work in developing countries claims its average project size is 400,000 dollars, with 200,000 dollars required to just break-even; and a U.S. design-construct firm claims its projects in developing countries are usually in the multi-million dollar category.

Construction multi-nationals in the developing countries have grown in importance for a variety of reasons. First, large industrial and public works projects often require highly sophisticated technology for their planning, design, and construction, and only the multi-nationals have the requisite skills and expertise. Second, even in projects which do not require particularly sophisticated technology, there is still a need for professional and managerial skills often lacking in local entrepreneurs. Finally, such projects require capital often not locally available, and international sources must be used. The international contractor can help the client get aid from these sources, or perhaps provide supplier's credit, and can provide his own working and investment capital.

Competition among multi-national firms in construction is now intense. Immediately after World War II continental Europe and Japan, with much rebuilding to do, had no need to go abroad for work. The U.K., with its far smaller need for reconstruction, was soon able to return to its former markets, largely the Commonwealth countries. The wider economic base of the U.S. and the growth of U.S. military aid and direct investment overseas gave U.S. firms an edge over their U.K. competitors. During the middle to late fifties the Italian, French, German, and Yugoslav firms in construction entered the overseas market. In 1956 a consortium of Italian companies surprised the international business world by winning the contract for the Kariba Dam. Japan entered the world construction market more recently, for the demand for construction at home, which was fed first by rebuilding and then by rapid economic growth, has now subsided.

Multi-national construction firms from these and other developed countries do large amounts of work in the developing countries. For example, U.S. firms in the ENR 400 (6) undertook 4.5 billion dollars of foreign construction work in 1969, while British foreign construction work in 1969 amounted to 233 million pounds (550 million dollars) (4), French to 4.8 billion French francs (900 million dollars), and Italian to 290 million pounds (700 million dollars). Even some developing countries are entering the field of international construction. Korean firms, for example, executed 56 million dollars worth of construction contracts in 1971 (see Table A2.10b). U.S. firms no longer so completely dominate the industry as they once did, for they have often priced themselves out of the market and U.S. military and bilateral aid to developing countries has been shrinking, thus eliminating some of the U.S. firms' competitive edge.

Since much foreign aid from different developed countries tends to be concentrated in particular areas of the developing world, multi-national firms tend to concentrate their activities in these same regions, one logical connection being the availability of their countries' tied aid. For example, about 70 percent of British overseas construction work in 1969 was situated in the Sterling area, the French have almost complete control of the market for foreign construction services in their former colonies in Africa, and U.S. firms have been very busy in Asia, the Far East, and Latin America. Multi-national firms in developing countries are naturally most competitive in the areas around them.

Firms in Korea and Taiwan, for example, have been able to underbid expatriate Western firms by 10 to 15 percent on projects in Asia (1). Their competitive advantage arises from lower overall cost of labor and associated services, familiarity with local bureaucracy, regulations, and customs, and excellent knowledge of and training in Western construction techniques.

Developed countries tend to specialize in certain types of construction as well. Multi-nationals in Italy, for example, are known as dam builders, the U.S. firms as nuclear power plant builders, and the British as bridge builders. Europe and Japan are more competitive than the U.S. in infrastructure creation, and multi-nationals in the developing countries also tend to concentrate on basic infrastructure projects. American firms, in fact, have largely withdrawn from competition on major normal infrastructure projects in Southeast Asia (1), tending rather to concentrate on highly technical industrial plants and the more sophisticated infrastructure. The provision of professional and managerial services, however, still rests mainly with the multi-nationals of the more developed countries, particularly Western Europe and the U.S.

This stiffer competition in the developing regions' construction market in recent years has resulted in the governments of the developed countries supporting their multi-national firms since overseas contracts improve a country's balance of payments. Bilateral agencies and private financing groups are giving improved credit terms to the multinationals and the developing countries. Governments are also researching possible projects for their multi-national firms and encouraging corporate cooperation on such projects. Canada, for example, finances feasibility studies with 50-year no-interest loans, since the country doing the feasibility study often gets the construction contract. All these factors lower client costs in the developing countries. Profit margins for the multi-nationals, moreover, have been shrinking, due to increased competition. The winning Italian consortium, for example, figured a 3 percent profit margin in its bid for the Kariba Dam; British and U.S. contractors, on the other hand, had been aiming at 14 percent profit margins on their projects. Stiffer competition has also resulted in a more vibrant multi-national construction industry whose firms are forced to innovate and increase efficiency in order to remain competitive.

It is important to look at the nature of the individual firm in multi-national construction in order to understand the character of its operations in developing countries. Thus far, data* on major U.S.-based multi-national firms serving as contractors, designers, or a combination of both in the field of construction overseas have been found (see Tables 4.1 and 4.2). Conclusions which can be drawn from these data should give at least some insight into the general nature of multi-nationals in construction.

Multi-national construction is typically undertaken by the largest

*The data on contractors and contractors who do design is from the ENR 400 (6), which represents the 400 largest contractors in the U.S. ranked on the basis of their contract awards (prime contract awards, share of joint ventures, and subcontracts awarded to company by other prime contractors) for the U.S. and abroad (except in 1963, then ranked only by U.S. awards). The data on designers is from the ENR 500 (7), which represents the 438 to 460 largest design firms in the U.S. (this number arises from the fact that 40 to 62 design-construct firms are included in the ENR 500 each year) ranked on the basis of billings for professional services related to construction (including fees, reimbursables, staff loans, or temporary staff transfers) for the U.S. and abroad. All foreign work is reported as a lump sum, and thus data on work in developing countries cannot be separated from that in developed countries.

Table 4.1a: Foreign work done by 400 top U.S. contracting firms[a] (source: ref. 6)

Year	Contract value			Firms that do design work		Contractors awarded new foreign contracts			
	Total	Foreign				Total		Also do design work	
	(Billion dollars)	(Billion dollars)	(Percent of total)	(Number)	(Percent of 400)	(Number)	(Percent of 400)	(Number)	(Percent of all those awarded foreign work)
1973	55	6.1	11.1	132	33.00	63	15.75	33	52.4
1972	40	3.6	9.0	125	31.25	71	17.75	39	54.9
1971	36	4.9	13.6	130	32.50	65	16.25	33	50.8
1970	32.4	4.0	12.3	120	30.00	64	16.00	31	48.4
1969	33.4	4.45	13.3	109	27.25	61	15.25	31	50.8
1968	28.6	3.5	12.2	95	23.75	68	17.00	34	50.0
1967	24.4	3.7	15.2	111	27.75	66	16.50	32	48.5
1966	21.9	3.7	16.9	91	22.75	67	16.75	36	53.7
1965	19	3	15.8	82	20.50	61	15.25	39	63.9
1964	16.1	2.1	13.0	99	24.75	61	15.25	31	50.8
1963[b]	11.2	0.9	8.0	100	25.00	50	12.50	32	44.0

[a] ENR 400.

[b] Ranked top 400 contractors by domestic volume rather than total. Each of 400 had ten million dollars or more in contracts in at least one of three years, 1961-1963.

Table 4.1b: Foreign work done by 40 top U.S. contracting firms[a] (source: ref. 6)

Year	Contract value			Firms that do design work		Contractors awarded new foreign contracts			
	Total	Foreign				Total		Also do design work	
	(Billion dollars)	(Billion dollars)	(Percent of total)	(Number)	(Percent of 40)	(Number)	(Percent of 40)	(Number)	(Percent of all those awarded foreign work)
1973	34.6	5.2	15.0	24	60.0	19	47.5	15	79.0
1972	21.8	2.6	11.9	23	57.5	25	62.5	16	64.0
1971	19.9	4.3	21.6	21	52.5	28	70.0	17	60.7
1970	17.5	3.6	20.6	24	60.0	24	60.0	19	79.2
1969	18.6	4.1	22.0	26	65.0	27	67.5	22	81.5
1968	15.6	3.0	19.2	24	60.0	25	62.5	19	76.0
1967	13.3	3.0	22.6	24	60.0	27	67.5	19	70.4
1966	11.2	3.2	28.6	26	65.0	31	77.5	21	67.7
1965	9.3	2.2	23.7	27	67.5	27	67.5	20	74.1
1964	7.7	1.9	24.7	25	62.5	26	65.0	17	65.4
1963[b]	4.2	0.6	14.3	21	52.5	19	47.5	12	63.2

[a]Top 10 percent of ENR 400.

[b]See footnote b, Table 4.1a.

Table 4.1c: Foreign work done by 40 top U.S. contractors compared to foreign work done by 400 top U.S. contractors (source: calculated from Tables 4.1a, 4.1b)

Year	Contract value of 40 top contractors as a percentage of the contract value of the 400		Number of 40 top contractors that do design as a percentage of number of 400 that do design	Number of top 40 contractors awarded new foreign contracts as a percentage of the number of the 400 awarded new foreign contracts	
	Total	Foreign		Total	Also do design work
1973	62.9	85.2	18.1	30.1	45.4
1972	54.5	72.2	18.4	35.2	41.0
1971	55.2	87.7	16.1	43.0	51.5
1970	54.0	90.0	20.0	37.5	61.2
1969	55.6	92.1	23.8	44.2	70.9
1968	54.5	85.7	25.2	36.7	55.8
1967	54.5	81.0	21.6	40.9	59.3
1966	51.1	86.4	28.5	46.2	58.3
1965	48.9	73.3	32.9	44.2	51.2
1964	47.8	90.4	25.2	42.6	54.8
1963	37.5	66.6	21.0	38.0	54.5

Table 4.1d: Distribution of the total and foreign volumes of construction done by the 400 top U.S. contractors[a] among various types of contractors (percent of the 400's total or foreign volume of new contract awards) (source: ref. 6)

Year	Total volume			Foreign volume		
	Industrial constructors	Diversified contractors[b]	General builders and heavy and highway contractors	Industrial constructors	Diversified contractors[b]	General builders and heavy and highway contractors
1973	39	32	29	64	28	8
1972	33	36	31	57	32	11
1971	21	39	40	37	47	16
1970	15	43	42	na	na	na
1969	19	43	38	53	42	5
1968	15	47	38	34	60	6
1967	14	49	37	24	66	10
1966	20	42	38	40	48	12
1965	na	na	na	na	na	na
1964[c]	38	50	12	25	69	6

[a]ENR 400.

[b]Do both heavy and building construction.

[c]Category of industrial constructors includes all building contractors, which in the case of foreign work are largely industrial constructors but in the case of total work are more split between industrial constructors and general builders with a somewhat larger share going to the latter.

Table 4.1e: Foreign work as a percentage of total work and number of contractors whose foreign work constitutes 50 percent or more of their total work, among the 400 largest U.S. contractors and the 40 largest U.S. contractors (source: ref. 6)

Year	Foreign work as a percentage of total work			Contractors whose foreign work constitutes 50% or more of total work	
	Minimum	Maximum	Median	(Number)	(% of those awarded new foreign contracts[a])
Top 400[b]					
1973	0.3	100.0	19.6	10	15.9
1971	0.2	86.0	16.3	10	15.4
1969	0.2	82.3	16.9	9	14.8
1967	1.0	100.0	16.8	16	24.2
1965	-[c]	92.5	25.0	11	18.0
1963[d]	0.3	90.9	18.4	9	18.4
Top 40[e]					
1973	2.6	96.6	29.8	4	21.1
1971	1.1	86.0	16.9	6	21.4
1969	5.0	82.3	26.7	6	22.2
1967	4.8	83.3	27.6	8	29.6
1965	-[c]	80.7	32.1	6	22.2
1963[d]	2.5	85.2	22.8	3	15.8

[a]See Tables 4.1a and 4.1b for number of contractors awarded new foreign contracts.

[b]ENR 400.

[c]0.004.

[d]See footnote b, Table 4.1a.

[e]Top ten percent of the ENR 400.

Table 4.2a: Architectural and engineering firms which work abroad in the ENR 500 (source: ref. 7)

Year	Billings			Total number of firms	Firms with foreign billings		Firms which handle foreign work	
	Total	Foreign						
	(Million dollars)	(Million dollars)	(Percent of total)		(Number)	(Percent of total)	(Number)	(Percent of total)
1973	2600	250	9.6	445	189	42.4	221	49.7
1972	2230	223	10.0	438	161	36.7	280	63.9
1971	2048	195	9.5	449	160	35.6	283	63.0
1970	1869	170.3	9.1	442	164	37.1	280	63.3
1969	1696.5	154.7	9.1	460	160	34.7	291	63.3
1968	1487.6	130	8.7	456	149	32.6	283	62.1
1967	1281.0	na	na	453	na	na	280	61.8
1966	1102.5	na	na	455	na	na	276	60.7
1965	955.0	na	na	454	na	na	279	61.5
1964	728	na	na	456	na	na	140	30.7

Table 4.2b: Architectural and engineering firms which handle foreign work in the top ten percent of the ENR 500 (source: ref. 7)

Year	Total number of firms in top ten percent of ENR 500	Firms which handle foreign work	
		(Number)	(Percent of total)
1973	45	40	88.9
1972	44	42	95.5
1971	45	43	95.6
1970	44	44	100.0
1969	46	46	100.0
1968	46	46	100.0
1967	45	44	97.8
1966	46	41	89.1
1965	45	45	100.0
1964	46	34	73.9

Table 4.2c: Number of firms which handle foreign work in the top ten percent of the ENR 500 as a percentage of the number of firms which handle foreign work in the whole of the ENR 500 (source: calculated from Tables 4.2a and 4.2b)

Year	Percent
1973	18.1
1972	15.0
1971	15.2
1970	15.7
1969	15.8
1968	16.2
1967	15.7
1966	14.9
1965	16.1
1964	24.2

Table 4.2d: Diversification in the architectural and engineering firms in the ENR 500 and in those in the ENR 500 which handle foreign work (source: ref. 7)

Type of design firm	1973	1972	1971	1970	1969	1968	1967	1966	1965	1964
Architect/engineers and engineer/architects										
Total - number	216	197	198	218	215	210	205	192	190	319[b]
- percent of all firms in the ENR 500[a]	48.5	45.0	44.1	49.3	46.7	46.1	45.3	42.2	41.9	70.0[b]
Foreign - number	110	129	133	134	143	131	122	127	119	na
- percent of all firms handling foreign work[a]	49.8	46.1	47.0	47.9	49.1	46.3	43.6	46.0	42.6	na
Foreign as percentage of total	50.9	65.5	67.2	61.5	66.5	62.4	59.5	66.1	62.6	na
Consulting engineers										
Total - number	177	188	190	166	186	178	180	179	178	137
- percent of all firms in the ENR 500[a]	39.8	42.9	42.3	37.6	40.4	39.0	39.7	39.3	39.2	30.0
Foreign - number	89	112	116	109	116	111	117	106	114	na
- percent of all firms handling foreign work[a]	40.3	40.0	41.0	38.9	39.9	39.2	41.8	38.4	40.9	na
Foreign as percentage of total	50.3	59.6	61.0	65.7	62.4	62.4	65.0	59.2	64.0	na
Architects										
Total - number	52	53	61	58	59	68	68	84	86	-[b]
- percent of all firms in the ENR 500[a]	11.7	12 1	13.6	13.1	12.8	14.9	15.0	18.5	18.9	-[b]
Foreign - number	22	39	34	37	32	41	41	43	46	na
- percent of all firms handling foreign work[a]	9.9	13.9	12.0	13.2	11.0	14.5	14.6	15.6	16.5	na
Foreign as percentage of total	42.3	73.6	57.4	63.8	54.2	60.3	60.3	51.2	53.5	na

[a] See Table 4.2a for total number of firms in ENR 500 and number of those who handle foreign work.

[b] Architects are included with architect/engineers and engineer/architects.

Table 4.2e: Diversification in the architectural and engineering firms in the top ten percent of the ENR 500 and in those which handle foreign work in the top ten percent of the ENR 500 (source: ref. 7)

Type of design firm	1973	1972	1971	1970	1969	1968	1967	1966	1965
Architect/engineers and engineer/architects									
Total - number	31	30	32	29	29	23	24	27	28
- percent of all firms in top 10% of ENR 500[a]	68.9	68.2	71.1	65.9	63.0	50.0	53.3	58.7	62.2
Foreign - number	26	28	30	29	29	23	23	23	28
- percent of all firms handling foreign work in top 10% of ENR 500[a]	65.0	66.7	69.7	65.9	63.0	50.0	52.3	56.1	62.2
Foreign as percent of total	84	93	94	100	100	100	96	75	100
Consulting engineers									
Total - number	14	14	13	15	16	19	19	17	17
- percent of all firms in top 10% of ENR 500[a]	31.1	31.8	28.9	34.1	34.8	41.3	42.2	37.0	37.8
Foreign - number	14	14	13	15	16	19	19	16	17
- percent of all firms handling foreign work in top 10% of ENR 500[a]	35.0	33.3	30.3	34.1	34.8	41.3	43.2	39.0	37.8
Foreign as a percent of total	100	100	100	100	100	100	100	94	100
Architects									
Total - number	0	0	0	0	1	4	2	2	0
- percent of all firms in top 10% of ENR 500[a]	0	0	0	0	2.2	8.7	4.4	4.3	0
Foreign - number	0	0	0	0	1	4	2	2	0
- percent of all firms handling foreign work in top 10% of ENR 500[a]	0	0	0	0	2.2	8.7	4.5	4.9	0
Foreign as a percent of total	-	-	-	-	100	100	100	100	-

[a]See Table 4.2b for total number of firms in the top 10 percent of the ENR 500 and number of those who handle foreign work.

Table 4.2f: Comparison of diversification in the architectural and engineering firms in the top ten percent of the ENR 500 with that in the firms in the whole of the ENR 500 (source: calculated from Tables 4.2d and 4.2e)

Year	Total number of firms--top 10% as a percentage of the ENR 500			Number of firms which handle foreign work--top 10% as a percentage of the ENR 500		
	Architect/engineers and engineer/architects	Consulting engineers	Architects	Architect/engineers and engineer/architects	Consulting engineers	Architects
1973	14.4	7.9	0	23.6	15.7	0
1972	15.2	7.4	0	21.7	12.5	0
1971	16.2	6.8	0	21.8	12.1	0
1970	13.3	9.0	0	21.6	13.8	0
1969	13.5	8.6	1.7	20.3	13.8	3.1
1968	11.0	10.7	5.9	17.6	17.1	9.8
1967	11.7	10.6	2.9	18.9	16.2	4.9
1966	14.1	9.5	2.4	18.1	15.1	4.7
1965	14.7	9.6	0	23.5	14.9	0

Table 4.2g: Total and foreign billings of the architectural and engineering firms in the ENR 500, by type of design firm (source: ref. 7)

Type of design firm	1972	1971	1970	1969
Architect/engineers and engineer/architects				
All billings				
- million dollars	1300	1200	1100	929.5
- percent of total billings of ENR 500[a]	58.3	58.5	58.9	54.8
Foreign billings				
- million dollars	117.9[b]	111.1[b]	98.6[b]	94.6
- percent of total foreign billings of ENR 500[a]	52.9	57.0	57.9	61.2
Foreign billings as percent of all billings	9.1	9.3	9.0	10.2
Consulting engineers				
All billings				
- million dollars	779	687	604	613.7
- percent of total billings of ENR 500[a]	34.9	33.5	32.3	36.2
Foreign billings				
- million dollars	100.6	81.4	69.6	58.5
- percent of total foreign billings of ENR 500[a]	45.1	41.7	40.9	37.8
Foreign billings as percent of all billings	12.9	11.8	11.5	9.5
Architects				
All billings				
- million dollars	151	161	165	153.3
- percent of total billings of ENR 500[a]	6.8	8.1	8.8	9.0
Foreign billings				
- million dollars	4.5[b]	2.5	2.1	1.5
- percent of total foreign billings of ENR 500[a]	2.0	1.3	1.2	1.0
Foreign billings as percent of all billings	3.0	1.5	1.3	1.0

[a]See Table 4.2a for total and foreign billings of firms in the ENR 500.

[b]These figures are estimated from information given in text of source.

firms in the field in the developed countries. Among the 400 largest contractors in the U.S. about 16 percent of them are awarded new foreign contracts in any one year; for the top 40 contractors this figure is 63 percent (see Tables 4.1a and 4.1b). The top 10 percent of the ENR 400 contractors thus account for 40 percent of the contractors in the ENR 400 winning foreign contracts and 83 percent of the foreign work awarded to contractors in the ENR 400 (see Table 4.1c). The degree of concentration is even greater in foreign than in domestic work, for these same 40 firms account for only 55 percent of the total awards to the 400 top contractors (see Table 4.1c).

Similar comments can be made about the design firms in the ENR 500. Some 60 percent of these firms handle foreign work, while 95 percent of the top 10 percent of these firms do so (see Tables 4.2a and 4.2b). The top 10 percent of the design firms in the ENR 500 thus account for better than 16 percent of the designers in the ENR 500 handling foreign work (see Table 4.2c). It is not surprising that more of the large design firms than construction firms work abroad considering that there is generally not only a greater need for them but also less risk and difficulties involved. Size also appears much less significant for designers than for contractors.

These findings are not unexpected, for in overseas work larger firms have important advantages over their smaller competitors. The enormous scale of the public works projects and the technical sophistication of the industrial plants necessitate the use of large firms for design and construction since only these firms can draw on the large quantities of financial, managerial, and technical resources required for such projects. Larger firms are also better equipped to handle the greater risks inherent in foreign projects. Information flows from foreign construction markets are harder to establish than are flows from domestic markets, and the larger firm can afford the extra expense needed to establish a world-wide communications system, while the greater commercial intelligence of the larger firm enables it to find sufficient foreign work. Finally, the larger company generally has more experience and more varied expertise and is thus better equipped to handle unfamiliar conditions.

Diversification of services performed by a single firm is another characteristic of multi-national construction firms. It has been becoming increasingly common for contractors to do design as well as construction on either the same or separate projects; more than 30 percent of the contractors in the ENR 400 have been doing design in recent years (see Table 4.1a). This figure is more than 50 percent among the firms in the ENR 400 doing foreign work, and has been for a decade (see Table 4.1a). Part of this tendency to diversify must be attributed to size, however, since 60 percent of the top 10 percent of the ENR 400 contractors have done design for the past ten years; 71 percent of the contractors in this group winning foreign contracts have done the same (see Table 4.1b). It seems the flexibility added by a contractor's doing design as well as construction is important in the multi-national construction market.

Diversification of services seems less important for the multinational design firms than for the multi-national contractors. Architect-engineers account for about 47 percent of the design firms in the ENR 500, consulting engineers for 40 percent, and architects for 13 percent; the corresponding figures for the top 10 percent of these design firms in recent years are 67, 32, and 1 percent (see Tables 4.2d and 4.2e). Diversification and size are thus distinctly correlated (see also Table 4.2f). These figures for the multi-national design firms are very similar, although there is some tendency for the multi-nationals to be more diversified in that about 63 percent of the architect-engineers, 61 percent of the consulting engineers, and 57 percent of the architects in the ENR 500 handle foreign work (see Tables 4.2d and 4.2e). Data on billings give a slightly different picture in that about 9 percent of all architect-engineers', 12 percent of all consulting engineers', and 2 percent of all architects' total billings are for foreign work (see Table 4.2g). The architect-engineer's advantage in overseas work is flexibility, while the consulting engineer's is the fact that much of the work is public works or industrial plant construction with considerable need for engineers but less for architects. Size seems particularly important in the case of the less diversified design firms in that nearly all architects and consulting engineers in the top 10 percent of the ENR 500 design firms are multi-nationals (see Table 4.2e).

The extent of diversification among types of construction is another feature of multi-nationals which should be considered. The data in Table 4.1d show that industrial constructors and diversified contractors take a much more active role in foreign work than do general builders and heavy and highway contractors in the U.S., and further suggest that multi-national contractors tend to be less specialized than the average contractor. Industrial constructors may be considered fairly specialized, however, and firms building highly technical and individualized industrial plants may do so only for one industry, often under a design-construct contract. Diversified contractors might be considered somewhat less specialized, although they largely concentrate on infrastructural projects and build only a few industrial or other projects overseas. Some companies may also specialize in particular areas of civil engineering, like Impregilo in Italy which concentrates on dam construction.

As was mentioned above, developed countries tend toward some specialization among types of construction, a fact which is apparent for the U.S. in the data in Table 4.1d. In the last ten years in this country there has been an almost complete reversal in the roles of industrial constructors and diversified contractors both in total and particularly in foreign sales, with industrial constructors now having the leading role.

Foreign contract awards account for anywhere from less than 1 percent to 100 percent of an ENR 400 multi-national contractor's total awards with a median figure of about 19 percent (see Table 4.1e). Somewhat less than a fifth of the multi-national contractors in the ENR 400 receive more than half of their revenue from foreign contracts (see Table 4.1e). The multi-national contractor thus typically concentrates most of its attention on domestic work with a relatively small share devoted to overseas work. This appears somewhat less true among the larger multi-nationals in that the median figure for foreign contracts as a share of total contracts for the multi-national contractors among the top 40 in the ENR 400 is somewhat higher, around 26 percent, while some 22 percent of them receive more than half of their revenue from foreign contracts (see Table 4.1e). Even this is a rather small percentage, however, and this whole issue may have significant implications on the behavior of multi-nationals in construction in developing countries.

Firms in the construction industry, particularly in the U.S., have long been characterized as having an easy entry/easy exit nature. This characteristic has to some extent been transferred to the multi-national firms in that a firm typically enters a country to do a particular project, does the job, and then leaves taking its equipment and personnel. A temporary office may be set up in the country, but it will remain open only so long as the company is working there, and much of the work may be sent back to the home country. It is becoming increasingly common for multi-nationals in construction to set up permanent offices or subsidiaries abroad, but these are primarily in the developed countries. The tougher competition, which makes closer contact with potential clients important in procuring work, and the increasing demand for construction and its related services in the developing countries are helping to encourage the multi-nationals to set up more permanent offices and even subsidiaries in these areas, however. Such trends have important positive implications for multi-nationals' operations in developing countries; they are even more promising if the staff positions in overseas offices and subsidiaries are filled as far as possible with local personnel and the major portion of the work is done there rather than being returned to the home country (a consulting firm interviewed (10) attributed at least a part of its success to practices along these lines.)

Joint venturing and subcontracting are two other practices of multi-national firms that require a brief discussion. Joint venturing among multi-national firms on an international scale is quite common and is most often done for financial or technical reasons. Joint venturing with local firms in the developing countries is less common, partly because many multi-nationals feel the locals are not sufficiently financially and technically competent, and they do not want to give away "trade secrets" and help create local entrepreneurial talent which one day may compete with them, and partly because in many developing areas there are few competent locals with which to joint venture. Joint venturing may be done because it is required, or at least preferred, by the government (e.g., in Brazil it is required), or because the multi-national finds it beneficial to do so because of the local's familiarity with the bureaucracy, rules, regulations, labor supply, construction conditions, and so forth.

Subcontracting a portion of the job to other multi-nationals or to local firms is also practiced. Subcontracting to local firms is preferred over joint venturing with locals by many multi-nationals because this leaves the multi-national in charge. Both joint venturing and subcontracting are important in the development of local industry and will be discussed further below.

It is useful to briefly consider the economic theory underlying the multi-national construction industry and some of its implications on the nature of multi-nationals' operations in developing countries. The multi-national construction industry fits neatly into the theory of international trade, for it is engaged in the export of goods and services. More specifically, it exports its professional, managerial, and technological skills and expertise as well as equipement and materials for which it is paid foreign exchange; such activities are clearly beneficial to the balance of payments at home. The problems of the multi-national construction industry are similar to those of any export industry, including, for example, foreign competition and restrictions on exports such as local regulations which prohibit the use of multi-national firms services or government visa and joint venturing regulations which restrict their operations.

Why one country becomes a dam builder and another a constructor of nuclear power plants in the developing countries is a question of the movements of international trade. The Heckscher-Ohlin model (2) takes the view that differing factor proportions in areas of the world cause the flow of trade. A capital-abundant, labor-scarce country, for example, would export capital-intensive products and import labor-intensive ones. The Leontief paradox (2, 9), which shows that the U.S., a capital-abundant country, is exporting labor-intensive goods and services and importing capital-intensive products, throws doubt upon the Heckscher-Ohlin theory and its assumptions, however. This theory also cannot adequately explain the multi-national construction industry which exports labor-intensive services to labor-abundant developing countries.

An alternative view of international trade, that of Linder (3), seems somewhat more appropriate. Here the precondition for a non-primary good or service to emerge as an export is the presence of home demand, for entrepreneurs react only to profit opportunities of which they are aware and they are usually first aware of domestic needs. The Linder argument further rests on the assumption that the production functions of goods demanded at home become the relatively most advantageous ones because of the learning-by-doing effects and the directing of research and development into these areas; it is such comparative advantage in the production function of a good or service that enables the country to export it. An export industry thus first starts producing for the home market, develops knowledge and expertise in the field which gives it advantages over its competitors abroad, and then proceeds to export its product.

A case in point in the multi-national construction industry is the emergence of Italian leadership in the dam building field. There has been a large demand for dams and hydroelectric plants in Italy, as evidenced by its 1500 dams and hydroelectric power stations, because of the shortage of fossil fuels but relative abundance of water power in the Alps. Italian contractors thus gained much expertise in building dams under difficult conditions and were able to become the most experienced and efficient builders in this field. Further, the Italians pioneered the use of concrete, which has become the prime construction material for dams, and the learning-by-doing effects of using this material also strengthened their superiority in dam construction. When dam production then slowed in Italy, it was natural for the dam builder to export his superior skills and technology.

The Linder analysis of international trade in the multi-national construction industry has some potentially important implications in considering the role of multi-nationals in economic development in developing countries. A good is first produced in the home country in response to local conditions, and the expertise thus developed results in a comparative advantage in the production function for the product. The production process (e.g., technological and managerial aspects) is thus attuned to the conditions such as factor proportions in the home country, and alteration of the process in order to adapt it to local conditions may be difficult, costly, and result in loss of the comparative advantage. Foreign sales, moreover, are only a relatively small portion of the total sales in most multi-national firms in construction, and efforts to adapt the process to developing country conditions may not be considered worthwhile. The extent to which this actually appears to be the case in multi-national construction will be considered in the next section.

4.2 The Nature of Multi-Nationals' Operations in Developing Countries

Multi-national firms in construction in the developing countries are primarily involved with the planning, design, and construction phases of the construction process. Their involvement with planning and design is predominantly in the form of manpower; in construction it is in the form both of manpower--management and labor--and of capital--materials and equipment. This section briefly considers how multi-nationals operate in these matters and why they behave as they do.

The planning and design phases of the construction process have relatively small capital and manpower requirements, but the needed manpower comes from a well-educated, experienced cadre of professionals with certain highly technical capabilities. Multi-national consulting and design firms play a major role in the execution of these activities in developing countries, for local capabilities are often under- or undeveloped.

Multi-nationals may joint venture with local professional firms if competent ones are available and it seems advantageous to do so. Some developing countries, particularly those with greater construction expertise like Latin America, require or at least prefer joint venturing, which results in more work being done in the developing country and therefore greater exposure to and participation in the activities by local people. Some explicit training may even occur which could be helpful to the locally educated engineers and architects primarily lacking on-the-job experience. It can also be a useful source of training for those with more limited skill requirements such as the more technical help like draftsmen, surveyors, and clerical workers. Some U.S. firms (10) reported that occasionally they bring local professionals to the home office to expose them to U.S. practices, largely in on-the-job training situations with additional formal education. This may also occur when the government is the client and has professionals on its staff even though there is no explicit joint venture.

Some multi-nationals may subcontract to local firms, allowing the local to perform some collection and analysis of data or a small part of the design, under the multi-national's supervision. The share of work done in the developing country and the potential involvement and training of locals are naturally less in this situation, although they are greater than if the multi-national does the whole job itself or in conjunction with other multi-nationals. Some developing countries require or provide incentives to encourage involvement of local professionals or some amount of training; this may help the education and involvement situation and may also encourage joint venturing with and subcontracting to locals.

A primary disadvantage of bringing in multi-nationals at the planning and design stage is that they may be insensitive to local conditions. As emphasized in Section 3.2, planning and design play major roles in the choice of technology, largely determining the resource mix and techniques used in the construction phase. A second disadvantage is that employing multi-nationals may tend to discourage development of local expertise in the field, because when the less industrialized countries come to rely on multi-nationals to do the work, local professionals may not be able to find positions worthy of their abilities. This latter argument is similar to that which maintains that the multi-nationals are hesitant to joint venture and train locals for fear they will provide competition. While this may be true in the long run, in the short run multi-national and local professionals are really in two separate markets, and neither will be likely to deprive the other of work.

The construction phase of the construction process places heavy demands on both manpower and capital. This phase naturally requires greater involvement with the local industry because it would be impossible to bring in all the manpower needed to do the actual construction. Joint venturing with local contractors seems somewhat riskier than with local professionals, but the potential advantages to the multi-national also seem greater. Subcontracting of less specialized tasks such as earthmoving to locals is common, although in some countries local contractors may have a core of well-trained management staff and may be able to handle more complex tasks. At the extreme is a multi-national professional or contractor subcontracting all the construction to local contractors while it manages the overall construction process from start to finish, although the handling of local labor is generally left to the local firms.

The chance of explicit training of and assistance to managers seems to be somewhat less in joint ventures and subcontracts in construction, and no multi-national reported bringing contractors to the home office to observe U.S. practices. This is probably a less serious omission than in the case of professionals, however, since just working with the multi-nationals results in some acquisition of experience, contact with new management and construction techniques, and encouragement of entrepreneurship on the part of local contractors. Even in the case of a multi-national contractor working alone or in conjunction with other multi-nationals, some experience may be passed on to local firms since assistance will probably be needed in the training of the local labor force which will undoubtedly be used in the construction itself. Again, developing countries may require contractor involvement or training at the managerial level or may offer incentives to encourage such responsiveness.

The multi-national contractor's fear of future competition from local firms seems more justified in the case of construction, for as mentioned above some local contractors, particularly in Latin America and the Far East, are beginning to compete with multi-nationals for the simpler infrastructural projects on a regional level. The result is that the multi-nationals from developed countries will either have to become more competitive or turn their attention to larger, more technically sophisticated projects and to providing professional services such as construction management.

As a general rule multi-national contractors try to employ a minimum number of foreigners in order to reduce costs. The developing countries may also have restrictions that require, or incentives that encourage (1) the use of locals if they are available, (2) the use of personnel only from the multi-national's home office, (3) limitations on the number of foreigners the contractor may bring in, or (4) limitations on the types (work category) of foreigners who enter. Multi-national contractors generally rely on foreigners for management because management capabilities in the developing countries are often under- or undeveloped, and because it is this managerial, organizational, and technical expertise that the developing country particularly seeks. Positions above and including supervisory personnel--superintendents, senior members of administrative staff, supervisors of maintenance workshops, and site foremen--are thus often held by foreigners although they may have local assistants. Clerical workers, on the other hand, who may be available or readily trained, are generally locals, although the multi-national may send some of this work back to its home office. Positions below the supervisory level, primarily those of construction workers and some foremen, are also generally held by locals.

It is impossible to get an average figure for the proportion of foreign to local staff on multi-national projects since it varies among projects, project types, parts of projects, multi-nationals, developing countries, and so forth. Some examples, however, can be given. Four link canal projects in the Indus Basin Works between January 1962 and July 1965 showed ratios of expatriates to local labor employed varying from 1:20.4 to 1:67.5 (5); these ratios are considered indicative of the situation in capital-intensive projects in developing countries where most of the major operational activities can be handled by local labor. An ILO survey (8) of international contractors reported a broad range of figures, with one firm estimating a ratio of 1 foreign supervisor to 50 workers on low skill jobs, 1:20 on jobs with medium level technical difficulty, and 1:5 on technically complex jobs.

Multi-national contractors recruit construction workers primarily from among the large pool of unskilled and semi-skilled labor, with the main criteria being good health, discipline, trainability, and adaptability; preference is generally given to those who have previously worked for an international contractor. Workers are often hired on a probationary basis, and according to the ILO survey (8) of international contractors only one in three workers thus recruited are retrained. In countries with less abundant labor pools the multi-national contractor may recruit workers from neighboring nations.

Skill shortages were repeatedly mentioned as a problem in developing countries in Section 3.33, but multi-national contractors generally overcome these through their own training activities or through the use of special work methods. Prefabricated components might be used for multi-unit construction where carpenters, electricians, and plumbers are in short supply, for example. Training is largely for the project at hand and thus its nature and extent depend upon the size, length, and needs of the project. Since complex jobs requiring skilled workers are generally broken down into highly specialized components, workers learn only narrowly specialized skills. The rotation of workers among the various activities would help to produce a more broadly trained labor force, but this is rarely done. Since training is not formal and systematic and is generally left up to the site foremen to organize, its effectiveness depends largely on the ability of the foremen and their assistants to impart skills and manage their workers. Locals may play an important part in this training process.

Workers up to the foreman level can be trained in this short-term, largely on-the-job manner, but those most commonly trained by multi-nationals are equipment operators, maintenance mechanics, welders, carpenters, shutterers, and, to a lesser extent, plumbers and electricians (8). In the Mangla Dam Project, for example, over 1500 equipment operators, 1300 mechanics, and 500 welders were trained by relatively few American and Pakistani instructors, and Pakistanis operated, maintained, and repaired virtually every one of the 2000 pieces of equipment used on the project (5). Such a training procedure does not and cannot produce fully qualified craftsmen, but it does provide workers with some skills and experience which may be applicable on other projects or make them more trainable. Multi-national contractors really cannot be expected to do much more as long as their operations are temporary in nature and they are not required to or given an incentive to provide more training.

Before considering the capital requirements of multi-national construction projects in the form of materials and equipment, it is useful to briefly review the financial arrangements. While the multi-national contractor generally provides his own working and investment capital, project financing is largely by sources outside the developing country. When the government is the client a major share of the financing generally comes in the form of export credits (often supplier's brought by the multi-national contractor), bilateral aid, or multilateral aid. The first two sources of funds are usually tied to the purchasing of goods and services from the donor's country--most often the same as that of the multi-national contractor. The third source of funds commonly covers only the foreign exchange component of the project. Such financial arrangements discourage the production and use of local materials and equipment and the use of labor-intensive techniques. One of the U.S. multi-national firms interviewed (10) related the following incident which occurred in Korea: the multi-national wanted to use reinforced concrete pipe rather than steel pipe because the former was available locally while the latter had to be imported; the government, however, said no because the project financing covered only the foreign exchange component and it wanted to reserve domestic funds for other needs. In projects where large international industrial firms are the client financing is largely by the industrial firm itself and by other private sources in its home country, which is probably the same as that of the multi-national contractor. While only a part of the funding may be tied to the home country, much of the materials and equipment have to be imported since they are probably too technically sophisticated to be available locally.

Multi-national designers report that they try to design around locally available materials and multi-national contractors that they try to build with them. A major constraint on the greater use of local materials is their limited availability and poor quality. Multi-nationals also may not be familiar with certain materials peculiar to a particular developing country and thus may be hesitant to use them. Another constraint may be the financing. As a result of these factors many imported materials are used; the most commonly employed local materials are sand, gravel, natural stone, and other bulk items, cement and cement products, and wood products.

An even greater share of the machinery and construction equipment is imported, although it may be at least partially assembled locally. Concern over reliable availability of spare parts as well as the other reasons mentioned above are responsible for this. Developing countries may place duties on imported goods in order to encourage the use of locally available goods. Import duties are often not placed on imported construction equipment, however, unless the contractor intends to sell it when he finishes the project; such a policy obviously does not serve to encourage multi-nationals to use locally available equipment.

The final area of concern in this section is the mix of labor and capital in multi-nationals' projects. Multi-national contractors tend to use familiar practices employed in their home country. Capital-intensive techniques are thus generally used by multi-national contractors, with the degree of capital-intensity the greatest for U.S.-based firms, less for European-based firms, and least for developing country-based firms.

According to the Linder theory of international trade this is quite logical, for it is these practices which have given them their comparative advantage, and alteration of these practices and thus factor proportions in an effort to adapt to the local conditions of the developing country may be difficult, costly, and result in the loss of their comparative advantage. This apparent technological inflexibility, in conjunction with inappropriate factor prices, may make it appear most economical to remain relatively capital-intensive. Foreign sales are also generally only a rather small share of total sales, and thus efforts to adapt the practices to developing country conditions may not be considered worthwhile.

Current policies of the agencies behind the financial resources for multi-national construction also militate against the use of the more labor-intensive techniques by the multi-national contractors. So, too, do a variety of other factors, including: (1) difficulties in the management and organization of projects involving large masses of labor, due largely to management's inexperience in this area; (2) lower productivity of labor; (3) additional time required for project completion; (4) poorer quality of work; (5) potentially high cost of welfare provisions if the project is in a remote location and the labor force is large; (6) a lack of research and knowledge about technologies other than capital-intensive ones; and (7) general bias against labor-intensive techniques in the developed and developing world, and in financial agencies (e.g., the IBRD required that construction of the Mangla Dam be highly capital-intensive and seemed rather unwilling to consider the use of more labor-intensive methodologies).

The major disadvantages the multi-national contractor sees in the use of the more capital-intensive techniques are the high cost of imported materials and equipment due to transport and import duties; the high cost of equipment upkeep in the form of supplies and spare parts, maintenance and repairs, depreciation, and possibly low utilization; and local regulations or incentives pertaining to increasing the employment and training of locals and limiting imports of materials, equipment, and manpower. One last element which may influence the contractor's choice of factor proportions but over which he has little or no control is the design and its flexibility in allowing various input mixes.

The above discussion is not meant to imply that multi-nationals make no effort to be adaptive to local conditions and practices, but that they are in business for economic rather than social reasons and that on a majority of projects they view capital-intensive approaches as most appropriate. The only way to change this, if it seems desirable to do so for at least some situations, is to develop and enforce rules and regulations requiring them to change their methods, or to develop economic incentives or alter existing conditions so as to encourage them to do so.

4.3 Potential Role of Multi-Nationals in the Development of the Indigenous Construction Industry of Developing Countries

The first two sections of this chapter have considered the current role of multi-nationals in the development of the indigenous construction industry of developing countries. Associated with each of the practices discussed are two sets of potential benefits and costs, one each for the multi-national firm and for the developing country. The motivation underlying the perspective of the developing country is economic development, while that underlying the perspective of the multi-national is first profit and second, if at all, altruistic considerations. Market forces as they presently exist thus cause the multi-national to behave as it does, and if it appears desirable to alter its behavior to conform with certain objectives of the developing country, it will then be necessary to alter these market forces in an appropriate direction.

Developing countries themselves or international agencies, agencies in developed countries, or developed countries acting in behalf of the developing countries might attempt to alter market forces by means of rules and regulations requiring appropriate changes in multi-nationals' behavior by providing incentives for such changes, or by altering existing conditions in such a way as to encourage such changes. This section considers various actions which might reconcile the commercial interests of the multi-nationals with the development interests of the emerging countries.

In its role as a client the government of a developing country can augment the role of multi-nationals in the development of the local construction industry. At the planning stage feasibility studies considering all levels of technology and the use of local as well as foreign resources (e.g., labor with simple tools versus heavy equipment for earthmoving operations, or a series of small dams versus a single large dam) can be required. Perhaps an evaluation methodology like national social benefit-cost analysis (13), which combines the various goals of economic development with a single measure of national economic profitability, can be used. At the design stage the government can require that designs be flexible and take local conditions into account.

In the planning and design contracts requirements or incentives pertaining to joint venturing, subcontracting, or some other form of involvement of local professionals, provision of employment and training for suitable local personnel, and performance of work in the developing country might be included if the local industry is sufficiently advanced to gain something from such arrangements. Construction contracts might include similar requirements or incentives as well as ones pertaining to the use of local materials and equipment. Part of the training costs might be refunded as an incentive to encourage training of locals, for example, if it is felt that this is a satisfactory training method.

The selection of the planner, designer, and contractor might be based on such conditions as well as on overall qualifications and/or price. A means to do this for the contractor within the bounds of competitive bidding might be to (1) require submission, along with the bid price, of guarantees of minimum local employment, training programs, minimum involvement of local contractors and subcontractors, maximum value of expatriate salaries, and maximum value of imported materials and equipment; (2) use these guarantees to value the bid with shadow prices for labor, foreign exchange, and capital; and (3) choose the bid with the lowest cost on a national economic profitability basis rather than the one with the lowest monetary cost. In such a situation the developing country must obviously make its shadow prices known to the contractors concerned. One final suggestion concerning contractual arrangements is some modification to allow more interaction and exchange among the planners, designers, and contractors. Design-construct or construction management contracts are two possibilities, although the former may encounter some difficulties due to financial arrangements.

In its role as client the government of a developing country might also attempt to stabilize construction demand through national planning of construction. The government might even provide work guarantees or undertake special contractual arrangements like the optional contract system in Korea (i.e., the contractor who is awarded the first part of a very large project has the option to negotiate for carrying out the remaining parts), which would essentially assure the multi-national of future jobs or give it some advantage in bidding on future jobs contingent upon present performance. Again, however, such arrangements are likely to encounter some financial difficulties. If the multi-national is provided with work which is potentially more than a one-shot deal, the firm may perform a larger share of the work abroad, establish permanent local offices staffed with local personnel and responsible for the major portion of work, become more involved with the local industry, train personnel more fully, more fully utilize local resources, and be more innovative in terms of adapting technology to local conditions.

One final thing the government must do in its role as a client is to rid itself of its bias against labor-intensive techniques and change its attitude toward maintenance so that high safety factors which require capital-intensive construction methods do not have to be built into projects.

The government of a developing country may also play an important role as policy-maker in influencing the nature of multi-nationals' operations. Economic incentives or tax-cum-subsidy schemes are probably the most direct and efficient means but are difficult to use because of political and institutional problems. Some such schemes include stimulation of training of locals through provision of subsidies, discouraging the use of imported materials and equipment through import duties, encouraging the use of labor on remote projects through subsidization of needed amenities, and encouraging the involvement of local contractors and professionals with tax incentives. It was noted in Section 4.2 that one of the reasons the multi-nationals operate as they do is inappropriate factor prices, and the use of shadow prices rather than market prices for the factor inputs in project evaluation and in the selection of multi-nationals was suggested. The government might instead eliminate any difference between these two prices for labor, capital, and foreign exchange by taxes or subsidies, thus forcing the firm to pay the true opportunity costs. Considerable difficulties may be encountered in estimating shadow prices and administering such policies, however.

In its role as policy-maker the government may also impose regulations and restrictions on the activities of multi-nationals, although this approach is somewhat less direct and effective than providing economic incentives. Some such regulations include requiring joint venturing with or subcontracting to local firms, quotas on imports of materials and equipment, requiring that expatriate personnel be from the multi-national's home office, not allowing visas when unemployed locals have the requisite skills, limitations on the number and type of expatriate personnel allowed to enter and be on a project, and minimum requirements for training of local personnel at all levels. As noted above, some developing countries are already using such regulations, and their use may be expected to expand with the increasing competition and subsequent lessening of multi-nationals' monopoly-like powers.

These government-initiated actions must take into consideration the level of development of the indigenous construction industry, whether the particular action under review is most beneficial to the industry as a whole, and the fact that the government's actions may vary among projects, depending upon individual circumstances. The developing country's government must promote the growth of the whole local construction industry, which includes local professionals, contractors, and manufacturers and suppliers of building materials and equipment. It appears that local industry needs to be at a certain level of development before multi-nationals can effectively help it grow further. Engineers need a professional degree from a local university before working with a multi-national will provide them with needed experience, construction workers can be more effectively trained by multi-nationals if they have some basic education, and local materials can be used only if they are available and of acceptable quality. The government of the developing country must also promote research in the development of materials, technical and managerial processes, and equipment particularly suited to the conditions of the country. This research might be done in government laboratories, building research stations, universities, and private arenas, and its results must be widely publicized.

Among the international agencies, agencies in developed countries, and developed countries' governments, the institutions responsible for financing multi-national construction are in a particularly strong position to influence the behavior of multi-nationals in developing countries through their policies affecting funding. This power has not always been used as effectively as it might, however, and some reforms are needed. Much of the official and private aid coming directly from developed countries is in the form of tied aid while aid from international financing agencies covers only the foreign exchange component; both policies serve to encourage importing materials and equipment and the use of capital-intensive techniques rather than the development and use of local resources. Tied aid has additional disadvantages such as reducing competition among suppliers of goods and services and thus potentially raising costs. While "un-tying" some of the tied aid would not help the export of goods and services from the donor country and might make investment somewhat riskier, it might at least be possible for official aid sources. An UNCTAD group of experts, for example, suggested that the beneficiary of tied aid might be authorized to use it to make purchases in other developing countries as well as in the donor country (12). International agencies might also provide funding for more than the foreign exchange component although this, too, would probably make investment riskier. The financial agencies might additionally attach requirements to their provision of funds such as stipulating that the multi-national contractor must joint venture with or subcontract to a local firm or that the firm must provide a certain amount of training for local labor. As an extreme measure they might stipulate that a portion of their funds be allocated to provide a local contractor with sufficient credit to joint venture or subcontract, or to institute a training program.

Another area in need of reform is the practice of international financing agencies restricting funds by requiring international competitive bidding which generally necessitates the separation of design and construction, and in some cases by even explicitly requiring that the firm responsible for the design not work on the construction. It has been mentioned repeatedly that closer collaboration between the multinational professional and contractor would be useful and might result in innovative approaches more suitable for local conditions in construction in developing countries. It seems the international agencies might relax these restrictions and allow the use of new contract forms such as design-construct and construction management. If competitive bidding were still desirable this should be no problem with construction management, and a modified form might even be possible with a design-construct contract. Some financing agencies also appear to have a bias against labor-intensive techniques; possibly the best way to alleviate this is for them to acquire greater knowledge about such techniques through their own research and that of others.

International agencies, agencies in developed countries, and developed countries' governments can probably have their greatest impact on the role of multi-national firms in the development of the indigenous construction industry of developing countries through their promoting, supporting, and performing research, and collecting, digesting, and disseminating information. Research in construction in the developed countries has long tended toward increasing capital intensity, and there is a scarcity of research and knowledge of less capital-intensive techniques which might potentially be more suitable for conditions in developing countries. Research is also needed in the area of materials indigenous to or particularly suited to developing countries. The research must encompass not only technical but also managerial and economic aspects of this field. Research into how the operations of multi-national firms might be more attuned to the development of the indigenous industry is also important.

The results of such research must be collected, digested, and disseminated if the multi-nationals and others are to begin to apply them. Research into the effective organization and control of a large mass of construction workers might be undertaken by one of these agencies, for example; once sufficient management techniques have been devised, the agency might sponsor educational programs to teach them to management personnel and publish and distribute manuals on these techniques. In this way one of the obstacles to labor-intensive construction methods might begin to be alleviated. In order to effectively perform such research and to better assist the developing countries in the entire field of construction, the agencies which do not yet have separate construction groups or divisions might want to form them; Cockburn (4), for example, suggests that the Ministry of Overseas Development, as the department responsible for official aid policies in the U.K., establish such a division.

CHAPTER 5

SUMMARY AND RECOMMENDATIONS

5.1 Summary

This report presents a state-of-the-art review of the construction industry in the developing countries, and identifies some of the potentials and barriers that exist for the transfer, adaptation, and development of an indigenous industry. It discusses the role of construction in the process of development and its importance to economic growth, employment creation, and income generation and re-distribution.

Our report considers the issues facing the growth of a viable indigenous construction industry in the developing world within the context of the activities involved in the creation of constructed facilities--planning, design, construction, and maintenance; it also examines the evnironment within which the industry has developed. For each construction activity the report reviews available capabilities, the various resources needed for the development of an indigenous industry, and some possible means of accommodating these needs.

In order to provide a specific focus for the discussions, the authors utilized information available on five emerging nations at different stages of development--Columbia, Korea, Iran, Kenya, and Ethipoia. These countries differed not only in economic, social, and political structure and in their extent of development, but also presented a wide variation in the availability of natural resources.

The report reviews multi-national construction firms as a potential means for the transfer, adaptation, and development of appropriate technologies to less industrialized countries, considering the firms' nature, the scope of their activities, and their evolving role in the development process. Opportunities available to the emerging nations for using the multi-nationals as a vehicle for the developmental process and possible incentives for such use are also discussed.

5.2 Recommendations

Our review of the state-of-the-art of the construction industry in developing areas has identified three broad categories of concern, the clarification and resolution of which would assist in the growth of an indigenous construction industry in emerging nations. These are the availability of data, the execution of detailed and well-documented case studies, and the existence of national planning of construction.

The lack of accurate, detailed, and comparable data on almost all aspects of construction activities in the developing and even in the developed countries has been a major difficulty in performing quantitative analyses of issues facing the industry. This difficulty is particularly serious once one becomes interested in a specific aspect of the industry or in a specific geographic region. A major reason given for this lack of data is that since construction is highly fragmented it is a difficult industry to identify. Its output fluctuates and is difficult to measure, and a large part of this output is outside the monetary sector. Because it uses goods and services from so many other industries, its inputs also are difficult to measure, but so too is its value added because of casual, often seasonal employment, piece-work pay basis, and the practice of moving equipment and personnel among sites, making it difficult to allocate amortization of plant and equipment, overhead, and profits to individual jobs. Measuring expenditures on construction by other sectors of the economy is also difficult.

While many of these arguments are valid, it is nevertheless crucial that at least some fundamental statistical series be set up. These should cover the structure of the industry; the production and use of construction output, materials, components, and equipment; the manpower situation; financial data; and similar items. Such data is needed on a national, regional, and local basis; unfortunately, it may not be available for many years in the developing countries. In the meantime, sample surveys and example studies of the industry's capacities and needs will have to suffice.

The report therefore recommends that the international agencies involved with the construction industry such as the International Bank for Reconstruction and Development, the United Nations, the International Labour Office, and the United Nations Industrial Development Organization commit certain resources to a systematic gathering, evaluating, and disseminating of information pertinent to the industry. The possibility of creating international data banks and information retrieval systems in this area would be highly valuable to the development of quantitative analyses of issues facing construction in emerging nations.

Carefully designed and implemented case studies of the construction industry in various regions of the world are needed if the issues facing the industry and its development are to be more fully examined. The report recommends that such case studies be done at the country, firm, and project level. On a country level the specific features of the industry in one or several countries can be examined, and cross-sectional data can be developed on a national level. The study of selected international, national, and local firms in construction should provide insight into the dynamics of their operations and the nature of their activities; issues such as managerial and design capabilities, labor relations, modes of financing, and so forth can be examined in depth for several cases. The issues of planning, organization, labor, materials, and financing could be studied on a project level.

Construction has traditionally been viewed as a service industry, and its output has been assumed to be dependent upon the demands generated by the sectors considered in national development plans. Consequently, no efforts have ever been made except in some East European countries to include the construction industry itself in national planning. Such planning is not an easy task and may require some aid in the form of regional cooperation and international technical assistance, but it is important that the construction component of the various parts of national development plans be extracted and that explicit national planning of construction be considered in developing countries. Planning departments need to know by type, region, and year the amount and cost of building and engineering work required of the industry to fill the country's development proposals. Such knowledge is necessary in order to define the demand for the industry's resources in the form of manpower, capital, materials, and equipment. This knowledge, in conjunction with an assessment of the industry's available resources, can serve to indicate areas of over- or under-supply, and measures can be proposed and efforts undertaken to make them more compatible. For example, short- and long-term training programs, investment in plant and equipment, and the development of new building materials industries might be planned; some construction might be postponed to give the industry a chance to develop and to lessen demand and supply fluctuations.

Staging of construction is an additional possible means by which the industry might be somewhat stabilized, for this makes construction a continuous rather than a project-oriented process. Only in this way can the development of the construction industry progress smoothly with the rest of the economy.

APPENDIX A

Additional Tables and Figures

Chapters 1 through 4

Table A1.1a: Estimates of total and per capita national income in market prices (source: ref. 3)

Region or country	Total (millions of dollars)						Per capita (dollars)					
	1960	1963	1968	1969	1970	1971	1960	1963	1968	1969	1970	1971
Market economies[a]	1,027,500	1,264,000	1,869,200	2,052,300	2,234,500	na	520	600	800	860	920	na
Developed market economies[a,b]	857,800	1,058,300	1,579,100	1,730,100	1,883,100	2,093,200	1,360	1,620	2,290	2,480	2,670	2,940
Developing market economies[a]	169,700	206,200	290,100	322,200	351,500	na	130	140	180	190	210	na
Africa[a]	32,100	38,800	54,400	59,800	na	na	120	130	160	170	na	na
Ethiopia[c]	na	964	1,387	1,527	na	na	na	44	57	62	na	na
Kenya[c]	na	831	1,208[d]	1,321[d]	1,469[d]	1,598[d]	na	91	115[d]	121[d]	131[d]	137[d]
Middle East[a]	17,600	21,800	35,800	39,900	na	na	220	250	360	390	na	na
Iran[e]	3,861	4,556	7,736	8,852	9,764	na	179	195	302	312	334	na
East and Southeast Asia (excluding Japan)[a]	67,600	82,000	103,200	115,300	na	na	90	100	110	120	na	na
Korea	na	3,556	5,402	6,729	7,804	8,455	na	132	181	220	250	265
Caribbean and Latin America[a]	60,100	73,300	112,000	124,400	140,000	na	290	330	430	460	510	na
Colombia	3,461	4,101	6,030	[illegible],730	7,734	na	225	242	304	329	366	na
United States	462,306	540,505	782,035[d]	838,961[d]	879,702[d]	946,778[d]	2,559	2,857	3,898[d]	4,139[d]	4,294[d]	4,573[d]

[a]Estimates for totals have been rounded to hundreds and for per capitas to tens.

[b]Including Europe, North America (U.S. and Canada), Oceania (Australia and New Zealand), Israel, Japan, and South Africa.

[c]These estimates involved adjustment of official estimates of an income measure related to national income; all others are official estimates of national income.

[d]These are in terms of the present SNA; all others are in terms of the former SNA.

[e]Twelve months beginning March 21 of the year stated.

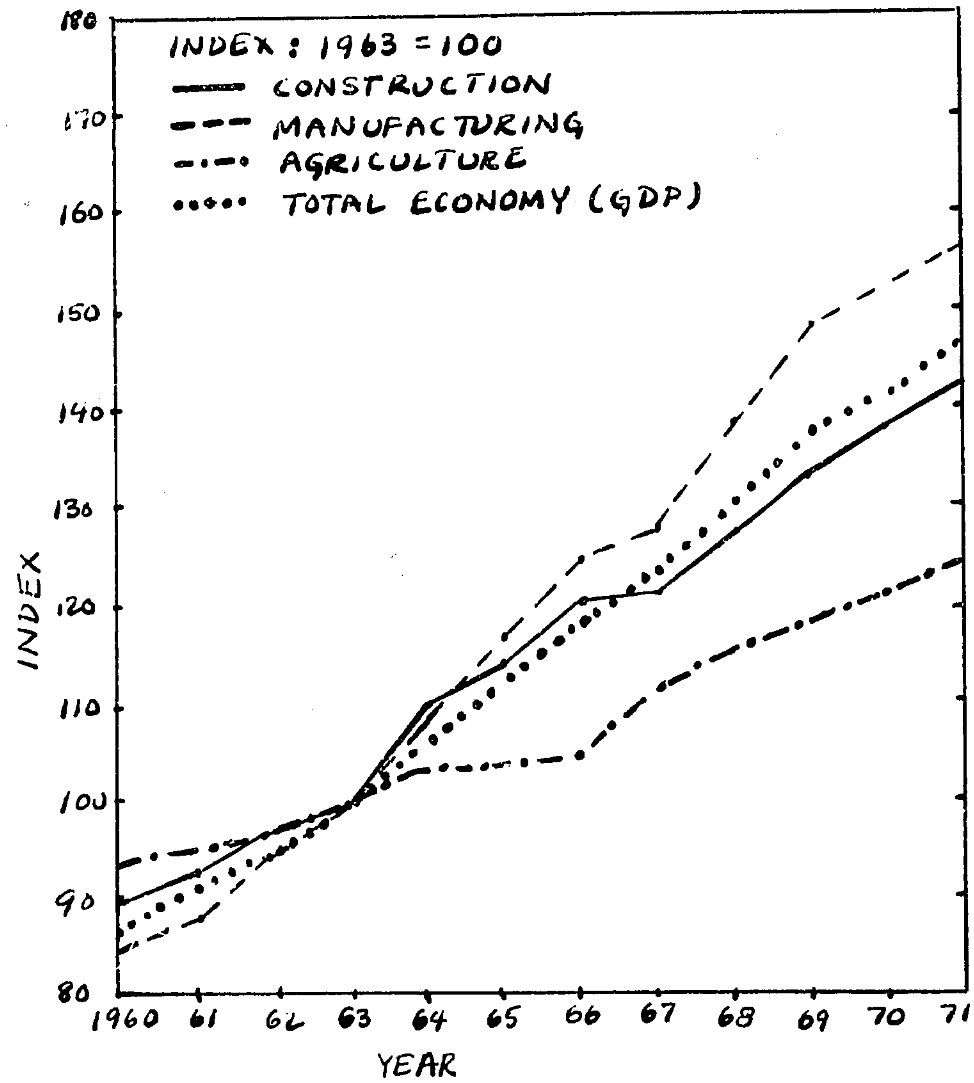
Table A1.1b: Income distributions in less developed countries[a] (source: ref. 1)

Country	Percentage of total income received by income receivers in income brackets of:				
	Lowest 20%	Lowest 50%	Lowest 60%	Highest 20%	Highest 10%
Latin America					
Argentina (1963)	7	na	32	50	37
Brazil (1960)	6	20	26	56	42
Chile (1960)	na	15.6	na	na	na
Colombia (1960)	6	20	na	57	43
Mexico (1963-64)	4	15	na	59	41
Venezuela (1960)	na	17	na	na	na
Asia					
Ceylon (1963)	5	20	30	52	37
India (mid-1950's)[b]	4-8	20-28	27-36	42-52	28-36
Pakistan (1963-64)	7	25	33	45	30
Philippines (1965)	4	na	23	57	40
Taiwan (1964)	8	28	37	41	26
Africa					
Congo (Brazzaville) (1958)	na	na	na	54	44
Gabon (1960)	na	na	na	71	60
Madagascar (1960)	na	na	na	na	50
Senegal (1960)	na	16	na	64	48
United States (1962)	6	23	31	48	34

[a] Income refers to pre-tax income of the individual for the African countries and to that of family units for all other countries.

[b] Various estimates have been made for India, as indicated by the ranges shown.

Figure A2.1: Index numbers of GDP[a], for the economy as a whole and certain sectors, in all market economies (source: ref. 30)



	1960–65	1965–70
GDP	5.2	4.8
Construction	5.1	3.9
Manufacturing	6.7	5.7
Agriculture	2.2	3.4

[a]Index numbers were compiled as weighted averages of country indexes of gross product at 1963 prices. The country indexes were generally derived from official estimates of GDP at constant prices by kind of economic activity in terms of the former SNA.

*Average annual growth rates at constant prices (percent).

Table A2.1: GDP and its distribution among various economic activities, for five developing countries and the U.S. (source: ref. 12,29)

Country and year	GDP in purchaser's values (millions of U.S. dollars)	Per capita GDP in purchaser's values (U.S. dollars)	Percentage distribution of GDP among certain economic activities[a]		
			Construction	Manufacturing	Agriculture
Ethiopia					
1961	na	na	5	6	62
1963	1020	47	6	7	61
1968	1469	61	6	9	55
1969	1615	65	5	10	52
Kenya[b]					
1960	na	na	3[c]	10[c]	40[c]
1964	924[d]	101[d]	4	10	38
1968	1344	128	5	11	33
1969	1454	134	6	11	32
1970	1618	144	6	12	31
Korea					
1960	na	na	3	14	37
1963	3732	139	3	15	42
1968	5685	190	5	20	29
1969	7085	232	6	21	29
1970	8281	265	6	21	28
Iran[e]					
1960	4365	203	4	25	27
1963	5278	226	4	28	25
1968	8912	348	5	32	21
1969	10198	359	5	32	19

(continued)

(Table A2.1continued)

Country and year	GDP in purchaser's values (millions of U.S. dollars)	Per capita GDP in purchaser's values (U.S. dollars)	Percentage distribution of GDP among certain economic activities[a]		
			Construction	Manufacturing	Agriculture
Colombia					
1960	3893	253	3	18	32
1963	4620	273	4	21	29
1968	6738	340	5	18	28
1969	7522	368	5	18	28
1970	8648	409	5	19	27
U.S.					
1960	509028	2817	4	28	4
1963	596341	3152	4	28	4
1969[b]	927876	4578	5	28	3
1970[b]	972581	4747	5	26	3
1971[b]	1045753	5051	5	25	3

[a]The percentage distribution is of the GDP in current producer's values by kind of economic activity in terms of the former SNA.

[b]Estimates relate to present SNA (GDP by kind of economic activity refers to the sum of the value added of resident producers, in producer's values, plus import duties).

[c]Data is calculated from GDP at current factor costs.

[d]Data is for 1963 and relates to former SNA.

[e]Twelve months beginning March 21 of year stated.

Table A2.2a: Index numbers of GDP[a], for the economy as a whole and certain sectors, in two developing countries and the U.S. (index: 1963 = 100) (source: ref. 29)

Country and year	Total economy (GDP)	Construction	Manufacturing	Agriculture[b] (all commodities)
Iran[c]				
1962	94	89	92	99
1964	108	120	113	96
1965	121	122	125	105
1966	132	121	139	105
1967	147	115	157	127
1968	162	106	174	134
1969	180	100[d]	195	131
1970	196	102[d]	218	132
1971	na	106[d]	256	126[d]
Colombia				
1953	65	65	54	na
1962	97	110	95	104
1964	106	100	106	110
1965	110	103	111	108
1966	116	121	118	111
1967	121	146	122	116
1968	128	160	130	120
1969	136	176	140	126
1970	146	183	151	135
1971	na	na	na	140[d]
U.S.				
1953	75	81	74	na
1962	96	98	95	95
1964	105	103	107	100
1965	112	105	118	100
1966	120	109	130	100
1967	123	114	132	108
1968	129	120	139	109
1969	132	130	146	108
1970	132	139	139	108
1971	135	149	138	116[d]

[a]Index numbers relate to GDP at constant prices by kind of economic activity in terms of the former SNA.

[b]The data for 1966 and earlier years was compiled on the basis of a split-year time reference period, e.g., data shown under 1964 refers to the harvest during the split year 1964/65 extending generally up to the first half of 1965. Since 1966, it has been compiled on a calendar-year basis.

[c]Manufacturing data relates to 12 months beginning March 21 of year stated and excludes tobacco and products of petroleum.

[d]Provisional, preliminary, or estimated figure.

Table A2.2b: Average annual rates of growth of GDP at constant prices by kind of economic activity, for five developing countries and the U.S. (percent)(source: ref. 29)

Country and period	Total economy (GDP)	Construction	Manufacturing	Agriculture
Ethiopia				
1965-69	4.6	6.4	13.1	1.8
1961-69	4.9	6.9	11.8	2.3
Kenya				
1965-70	7.3[a]	12.6	8.1	6.5
1964-70	7.0[a]	11.6	7.6	5.5
Korea				
1965-70	12.2	25.2	22.6	3.0
1960-70	9.5	19.5	17.6	4.3
Iran				
1965-70	10.3	7.7	15.2	5.9
1960-70	9.2	9.7	13.1	4.3
Colombia				
1965-70	5.7	12.5	6.2	4.8
1960-70	5.1	7.3	5.7	3.6
U.S.				
1965-70	3.4	-0.1	3.0	4.4
1960-71	4.3	1.1	4.9	2.7

[a]Estimates relate to the present SNA.

Table A2.3: Employment and index numbers of employment, in the economy as a whole and various branches of economic activity, in two developing countries and the U.S. (source: ref. 12)

Country and year	Number (thousands)				Index (1963 = 100)			
	Total economy	Construction	Manufacturing	Agriculture	Total economy	Non-agricultural sectors	Construction	Manufacturing
Kenya[a]								
1964	589.6	22.0	60.8	208.3	96.3	100.0	100.0	100.0
1965	594.0	21.4	65.7	209.5	97.4	100.8	97.2	106.4
1966	577.5	31.0	66.5	211.9	98.0	95.5	141.1	106.6
1967	597.5	29.9	68.3	190.1	100.0	100.0	100.0	100.0
1968	606.4	31.9	70.7	190.2	101.5	102.2	106.7	103.5
1969	627.2	28.9	72.7	195.0	105.0	106.1	96.8	106.4
1970	644.5	30.8	82.3	204.5	107.9	108.0	103.1	120.5
1971	679.7	34.8	92.8	211.1	113.8	115.0	116.4	135.9
Korea[b]								
1963	7,947	200	631	5,021	100.0	100.0	100.0	100.0
1964	8,210	192	670	5,084	103.3	107.0	97.6	100.2
1965	8,522	245	800	5,000	107.2	120.5	113.7	125.8
1966	8,659	213	857	5,013	109.0	124.8	106.5	138.0
1967	8,914	264	1,043	4,924	112.2	136.6	140.5	175.4
1968	9,261	317	1,181	4,863	116.5	150.5	177.4	206.2
1969	9,347	333	1,222	4,798	117.6	155.7	178.0	210.7
1970	9,574	279	1,260	4,834	120.5	162.2	144.6	215.6
1971	9,708	333	1,287	4,709	122.2	171.1	179.8	204.2
1972	10,026	371	1,372	5,078	126.2	169.3	204.8	242.2
U.S.[c]								
1963	67,762	2,963	16,995	4,687	100.0	100.0	100.0	100.0
1964	69,305	3,050	17,274	4,523	102.3	102.7	102.9	101.6
1965	71,088	3,186	18,062	4,361	104.9	105.8	107.5	106.3
1966	72,895	3,275	19,214	3,979	107.6	109.3	110.5	113.1

(continued)

(Table A2.3continued)

Country and year	Number (thousands)				Index (1963 = 100)			
	Total economy	Construction	Manufacturing	Agriculture	Total economy	Non-agricultural sectors	Construction	Manufacturing
1967	74,372	3,208	19,447	3,844	109.8	111.8	108.3	114.4
1968	75,920	3,285	19,781	3,817	112.0	114.3	110.9	116.4
1969	77,902	3,435	20,167	3,606	115.0	117.8	115.9	118.7
1970	78,627	3,381	19,349	3,462	116.0	119.2	114.1	113.9
1971	79,120	3,411	18,529	3,387	116.8	120.1	115.1	109.0
1972	81,702	3,521	18,933	3,472	120.6	124.0	118.8	111.4

[a]Date is June of each year. Data is based on statistics of establishments (number of employees). Employment in rural areas, except for large enterprises, is excluded (thus agriculture is large farms only), beginning in 1964 for the total economy index, in 1966 for employment in numbers, and in 1967 for the other indexes. Base year for the total economy index is 1967; at for the other indexes is 1964 for 1964 through 1966 and 1967 for 1967 through 1971.

[b]Data includes persons aged 14 years and over and is based on labor force sample surveys (civilian labor force employed).

[c]Data includes persons aged 16 years and over. Figures for construction and manufacturing are from statistics of establishments in the private sector (number of employees); the rest are from labor force sample surveys (civilian labor force employed).

Table A2.4: Percentage distribution of gross fixed capital formation[a] in construction, by type of construction, for Colombia, Kenya, Korea, and the U.S. (percent) (source: 30)

Country and year		Residential buildings	Nonresidential buildings	Other construction except land improvement	Land improvement and plantation and orchard development
Colombia	1960	34.6	11.6	45.1	8.7
	1963	37.6	12.1	41.7	8.6
	1966	33.3	5.2	49.8	11.7
	1967	27.2	4.6	57.7	10.5
	1968	26.7	5.2	58.2	10.0
	1969	24.4	5.6	57.2	12.8
	1970	26.2	4.3	56.2	13.2
Kenya[b]	1964	34.6	24.0	33.7	7.7
	1965	34.8	23.1	36.7	5.4
	1966	32.5	21.6	41.0	4.9
	1967	31.1	25.4	39.6	4.0
	1968	31.2	27.9	36.6	4.3
	1969	32.0	28.1	35.2	4.7
	1970	33.7	25.4	36.8	4.1
	1971	31.1	22.9	42.7	3.3
Korea[c]	1960	29.4	35.6	35.0	-
	1963	16.5	34.1	49.4	-
	1966	18.7	34.3	47.0	-

(continued)

(Table A2.4 continued)

Country and year		Residential buildings	Nonresidential buildings	Other construction except land improvement	Land improvement and plantation and orchard development
(Korea, cont.)	1967	19.2	35.9	44.9	-
	1968	21.0	33.9	45.0	-
	1969	16.7	32.6	50.7	-
	1970	21.1	33.3	45.6	-
	1971	23.6	31.8	44.7	-
United States[c]	1960	42.2	33.1	24.7	-
	1963	42.2	30.6	27.2	-
	1966	33.2	37.4	29.4	-
	1967	31.9	37.4	30.7	-
	1968	34.3	34.7	31.0	-
	1969	34.9	36.0	29.1	-
	1970	33.2	35.4	31.4	-
	1971	39.0	32.1	28.9	-

Note: Detail may not add to totals due to rounding.

[a]Gross fixed capital formation in former system of national accounts in purchasers' values at current prices.

[b]Present SNA.

[c]Land improvement and plantation and orchard development included with other construction except land improvement.

Table A2.5a: Negotiated building contracts as a percentage of the dollar volume of all building contracts of 333 general contractors in the U.S.[a] (source: ref. 6)

Dollar volume of negotiated contracts as a percentage of all contracts	Number of respondents	Percentage distribution
none	25	7.5
less than 10%	101	30.3
10-19%	72	21.6
20-39%	57	17.1
40-59%	39	11.7
60-100%	39	11.7
Total	333	100.0

Note: Percentages do not add to 100.0 because of rounding.

[a] These are the results of a mail survey carried out by Cox and Goodman (6) presumably sometime around 1962 though the authors do not specify a date.

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Table A2.5b: Type of contract adjudication for the construction industry in Korea (source: ref. 9)

Type of contract awarded	1966		1967		1968		1969		1970	
	Number	% of total	Number	% of total	Number	% of total	Number	% of total	Number	% of total
<u>Number of contracts awarded</u>:										
Total	18,569	100.0	19,827	100.0	24,336	100.0	28,625	100.0	32,225	100.0
Contracts let by open competitive bidding	9,913	53.4	7,813	39.4	10,532	43.3	9,953	34.8	10,605	32.9
Contracts let by invited bidding	5,337	28.7	8,162	41.2	8,038	33.0	12,489	43.6	14,714	45.7
Contracts let by negotiation	3,319	17.9	3,852	19.4	5,766	23.7	6,183	21.6	6,906	21.4
<u>Value of contracts awarded (million won)</u>:										
Total	46,263	100.0	66,625	100.0	123,331	100.0	173,056	100.0	183,256	100.0
Contracts let by open competitive bidding	9,364	20.2	8,897	13.4	21,236	17.2	22,180	12.8	26,337	14.4
Contracts let by invited bidding	23,911	51.7	34,057	51.1	52,212	42.3	81,821	47.3	89,999	49.1
Contracts let by negotiation	12,989	28.1	23,671	35.5	49,883	40.5	69,054	39.9	66,920	36.5

Table A2.6: Development of size of building firms in various developed countries (source: ref. 27)

Country	Change of average number of employees	In the years	Number of firms	In the year
United States	9.4-11.2	1953-62	473,000	1962
Japan	6.7-10.4	1954-60	245,500	1962
Belgium	9.8-11.1	1953-63	24,915	1963
France	4.9-5.2	1958-62	252,549	1962
Germany (Fed. Rep.)	8.9-13.2	1950-61	160,196	1961
Italy	12.5-11.3	1951-61	81,494	1961
Norway	11.5-9.5	1936-53	7,141	1953
Sweden	8.3-8.9	1931-51	27,440	1951
United Kingdom	13.8-16.4	1954-48	95,629	1958

Table A2.7: Concentration of building production in various developed countries[a] (source: ref. 27)

Country	Percent of construction firms	Corresponding percentage of building production
United States	1.7	80.0
United Kingdom	1.9	58.3
Germany (Fed. Rap.)	4.8	45.8
Canada	6.0	47.6
France	4.2	70.0
Sweden	0.01	24.7

[a]Source lists no specific year, but data are presumably from 1964 or 1965.

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Figure A2.2: Number of reporting units for contract construction and manufacturing in the U.S., by the number of employees the establishment had, in March 1966 (source: ref. 16)

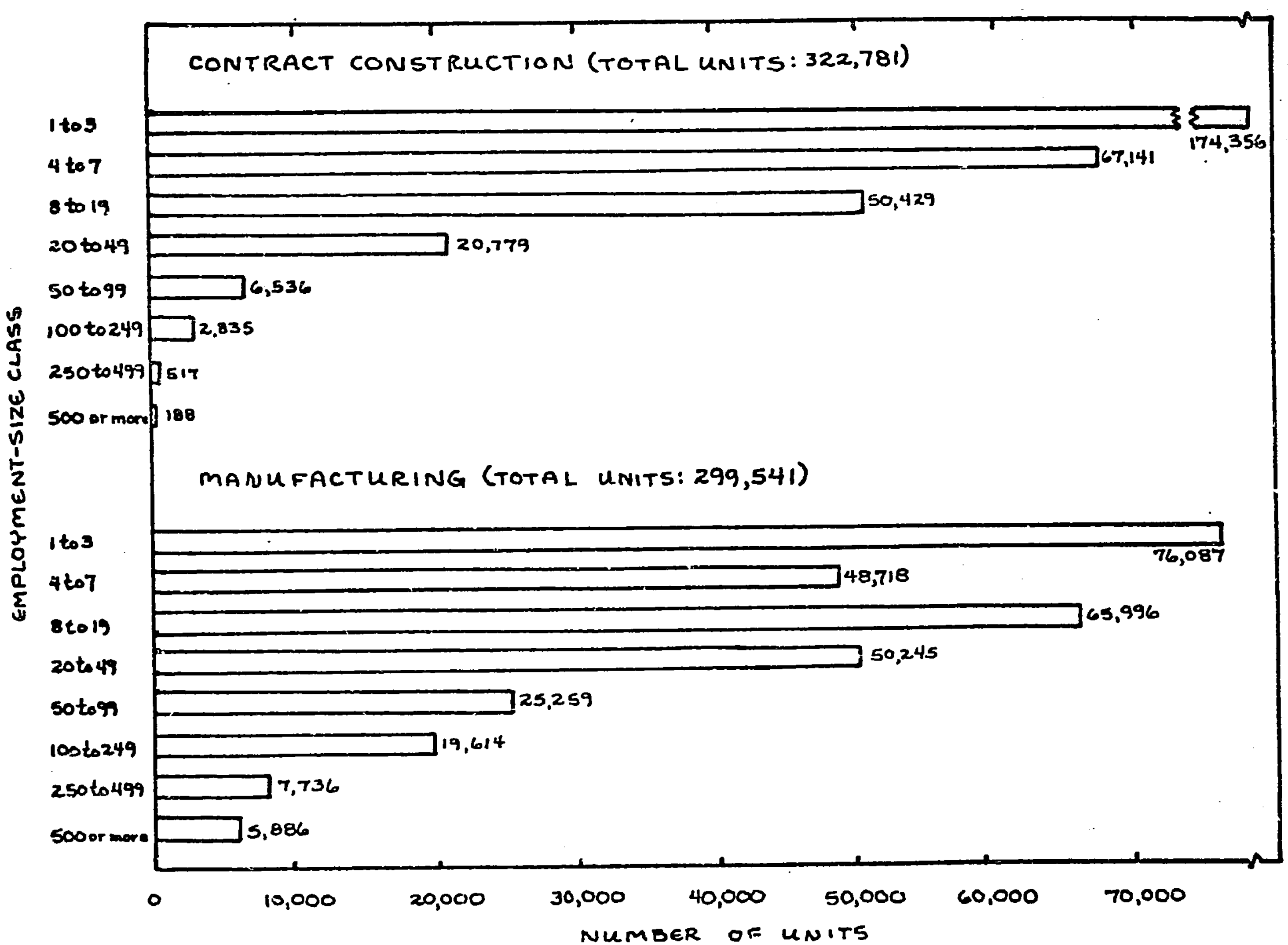

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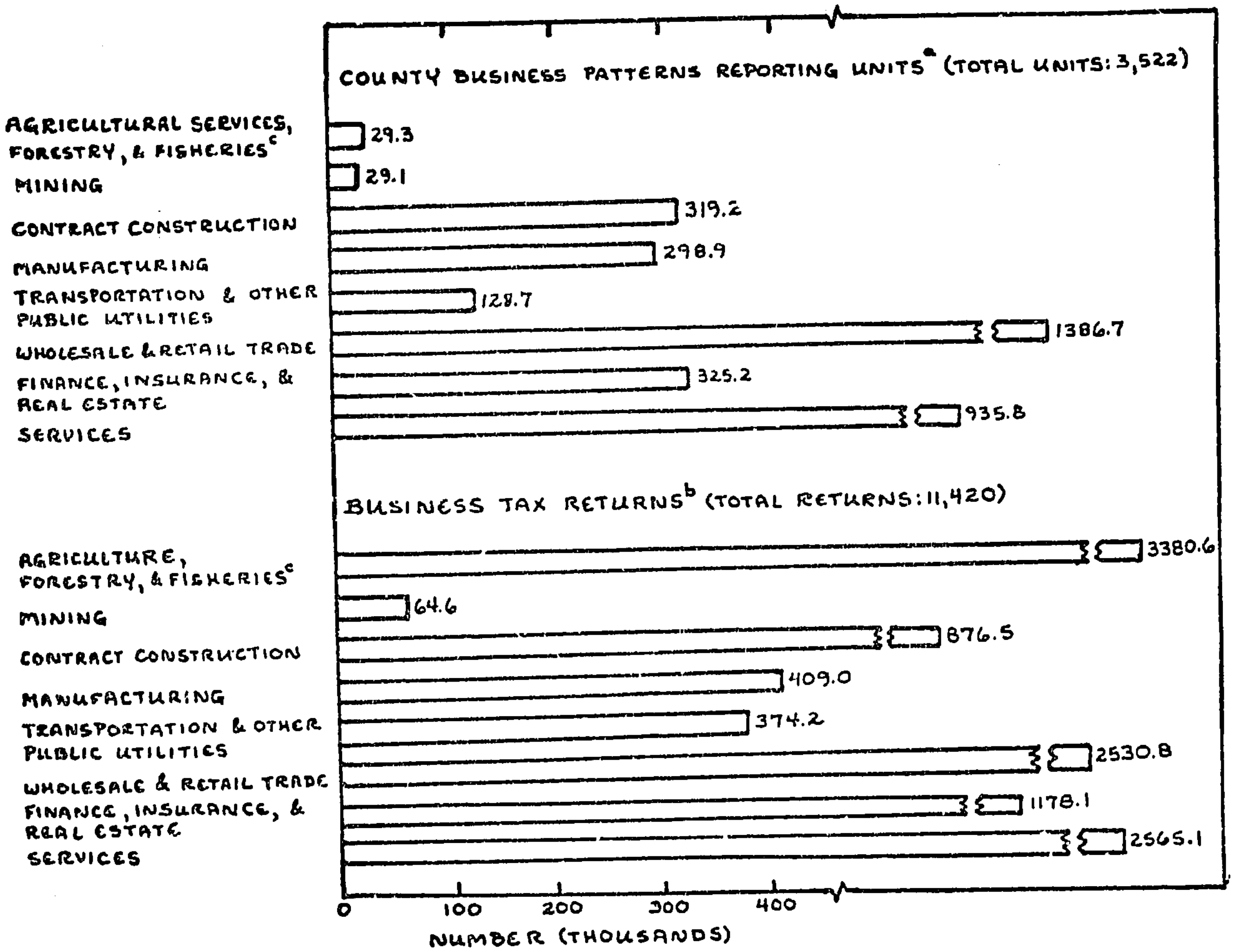
Figure A2.3a: Number of reporting units and number of returns for contract construction and various other industries in the U.S., for 1965 (source: ref. 16)



[a]Number of reporting units indicates the number of establishments which have employees (not including self-employed persons) subject to the Social Security program.

[b]Number of returns indicates the number of businesses, with and without employees, which file federal business tax returns. The difference between this and the number of reporting units in contract construction is primarily accounted for by the sole proprietorships without employees.

[c]County business patterns, unlike business tax returns, include only the agricultural services part of the agriculture sector; agricultural production is excluded.

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Figure A2.3b: Business receipts for contract construction and various other industries in the U.S., for 1965 (billions of dollars) (source: ref. 16)

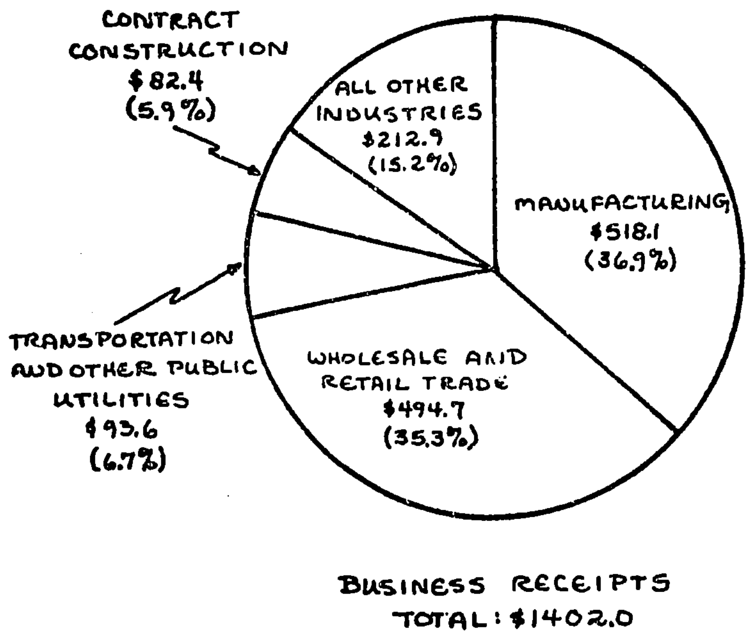

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Table A2.8: Number of firms, numbers employed, and gross output in the building and construction industry in the United Kingdom, for 1935 and 1954 (source: ref. 3)

Number of employees	1935					1954				
	Firms		Employees		Gross output	Firms		Employees		Gross output
	Number	% of total	Number (1000's)	% of total	% of total	Number	% of total	Number (1000's)	% of total	% of total
Not more than 10 persons	67,450	88.6	255.0	33.7	28.5	72,407	81.7	235.3	19.3	11.9
11-99 persons	7,716	10.1	252.9	33.4	31.7	14,462	16.5	417.5	34.2	32.0
100-499 persons	868	1.1	163.0	21.5	24.4	1,464	1.6	281.4	23.1	24.9
500 persons and over	78	0.2	86.3	11.4	15.4	202	0.2	286.4	23.4	31.2
Total	76,112	100.0	757.2	100.0	100.0	88,535	100.0	1,220.6	100.0	100.0

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Table A2.9: Construction firms and operatives analyzed by trade in the United Kingdom[a] (source: ref. 24)

Description of firm by predominant trade	Number of firms	Number of operatives	Average number of operatives
General builders	34,732	284,866	8
Building and civil engineering contractors	3,022	350,785	117
Civil engineers	1,473	89,749	61
Plumbers	8,417	35,595	4
Carpenters and joiners	5,624	24,331	4
Painters	13,907	56,911	4
Roofers	1,508	14,902	10
Plasterers	3,141	20,985	7
Glaziers	301	3,905	13
Demolition contractors	290	3,365	12
Scaffolding specialists	81	6,674	82
Reinforced concrete specialists	216	11,857	55
Heating and Ventilating	1,315	36,226	27
Electrical contractors	4,434	59,367	13
Asphalt contractors	250	14,122	57
Plant hirers	1,006	18,221	18
Flooring contractors	716	8,466	12
Constructional engineers	436	25,854	59
Total	80,869	1,064,191	13

[a]No specific date is indicated for this data, but the date of the publication is 1973.

Table A2.10a: Volume of construction work performed by contractors[a] in Korea (millions of won) (source: ref. 9)

Amount of contracts performed	1962	1965	1966	1967	1968	1969	1970
Residential, commercial, and industrial building	8,063	11,484	20,612	31,060	60,138	77,926	86,075
by Korean firms	na	na	na	na	55,806	69,236	77,228
by foreign firms	na	na	na	na	4,322	8,690	8,847
% by foreign firms	na	na	na	na	7.2	11.2	10.3
Civil engineering works	6,568	11,952	19,769	29,187	66,724	88,123	83,830
by Korean firms	na	na	na	na	61,740	79,831	77,463
by foreign firms	na	na	na	na	4,984	8,292	6,367
% by foreign firms	na	na	na	na	7.5	9.4	7.6
Grand total	14,631	23,436	40,381	60,247	126,862	166,049	169,905
by Korean firms	na	na	na	na	117,546	149,067	154,691
by foreign firms	na	na	na	na	9,316	16,982	15,214
% by foreign firms	na	na	na	na	7.3	10.2	9.0

[a]Does not include work carried out by small contractors not licensed by the Ministry of Construction (of 2626 contracting enterprises, including 1584 "individuals" active in Korea in 1971, only 713 were thus licensed) or residential building done by artisans employed directly by the prospective house owner.

Table A2.10b: Value of construction contracts executed by Korean firms abroad (source: ref. 9)

Year	Number of contracts	Value (thousands of U.S. dollars)	Number of countries[a]
1966	7	11,003	3
1967	13	15,604	3
1968	12	20,578	3
1969	12	14,400	2
1970	19	47,989	9
1971	17	56,139	9

[a] Before 1970, construction was done in Vietnam (36 of the 44 contracts for 1966-1969), Japan, Guam, Ryuku, and Thailand. In 1970 and 1971, work was also executed in Saipan, Indonesia, Taiwan, Brunei, Pakistan, Australia, Alaska, Canada, Dominica, and Malaysia.

Table A2.10c: Construction engineers in Korea in 1971 by grade (source: ref. 9)

Type of engineer	Classification			Total
	Grade A	Grade B	Grade C	
Civil engineers	451	1,691	4,288	6,430
Mechanical engineers	47	200	374	621
Architectural engineers	268	1,183	4,420	5,871
			Total	12,922

Table A2.11a: Registered contractors in Iran by type of work and qualification[a] (source: ref. 9)

Type of work	Contract qualification[b]			Total
	Class 1	Class 2	Class 3	
Roads	60	160	106	326
Building	150	214	40	404
Large bridges	no classification			24
Municipal water supply and sewerage	70	100	6	176
Power distribution and transmission	18	26	-	44
Deep well drilling	no classification			13
Steel structures	21	18	-	39
Heating, ventilating, air conditioning	16	21	-	37
Dams, irrigation canals and drainage	45	39	-	84
			Total registrations	1147

[a]Source gives no date for figures, but date of publication is 1973.

[b]Contracts are classified by value and vary with the type of work. Values listed are in million rials. Roads - Class 1: over 100, Class 2: 15-100, Class 3: to 15; Building - Class 1: over 40, Class 2: 10-40, Class 3: under 10; Municipal water supply and sewerage - Class 1: over 20, Class 2: 5-20, Class 3: to 5; Power - Class 1: over 7.5, Class 2: to 7.5; Steel structures - Class 1: over 5, class 2: to 5; Heating - Class 1: over 7.5, Class 2: to 7.5; Dams - Class 1: over 20, Class 2: to 20.

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Table A2.11b: Construction companies registered in Tehran, Iran (source: ref. 9)

Year	Number	Capital (million rials)
1966/67	105	715.5
1967/68	146	630.8
1969/70	86	816.1
1970/71	78	383.6

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Table A2.11c: Construction companies dissolved in Iran (source: ref. 9)

Year	Number	Capital (million rials)
1966/67	14	25.1
1967/68	22	95.7
1968/69	34	185.4
1969/70	28	134.5
1970/71	21	265.7

Table A2.12a: Contractors registered under prevailing classification system in Ethiopia[a] (source: ref. 9)

Type of contractor	Classification[b]							Total
	Class 1	Class 2	Class 3	Class 4	Class 5	Class 6	Class 7	
General contractors	11	8	8	8	11	5	2	53
Number of foreign[c]	8	6	4	6	5	3	1	33
Number of Ethiopian	3	2	4	2	6	2	1	20
Building contractors	-	2	2	12	12	15	29	72
Number of foreign[c]	-	2	2	8	9	6	6	33
Number of Ethiopian	-	0	0	4	3	9	23	39
Special contractors	-	-	2	0	1	1	1	5
Number of foreign[c]	-	-	2	0	1	1	1	5
Number of Ethiopian	-	-	0	0	0	0	0	0
Registered consultants	no classification							6
Number of foreign[c]								6
Number of Ethiopian								0

[a]Source gives no date for figures, but date of publication is 1973.

[b]Classification by maximum contract limitation in Ethiopian dollars. Class 1: 5,000,000, Class 2: 2,500,000, Class 3: 1,000,000, Class 4: 500,000, Class 5: 250,000, Class 6: 100,000, Class 7: 50,000.

[c]Local resident contractors of foreign nationality and local branches of international construction firms.

Table A2.12b: Contractors, architectural and engineering consultants, and professional architects, engineers and surveyors registered in Ethiopia under new guidelines[a] (1971-72) (source: ref. 9)

Type of contractor and classification	Number of foreign[b]	Number of Ethiopian	Total
General contractors	6	4	10
Class 1	2	1	3
Class 2	2	0	2
Class 3	0	1	1
Class 4	0	1	1
Class 5	0	1	1
Class 6	2	0	2
Building contractors	5	8	13
Class 2	2	0	2
Class 4	1	1	2
Class 5	0	1	1
Class 6	1	1	2
Class 7	1	5	6
Special contractors	0	1	1
Class 4	0	1	1
Architectural consultants	2	0	2
Engineering consultants	2	0	2
Professional architects	0	1	1
Professional engineers	0	4	4
Professional surveyors	0	1	1

[a]New guidelines include the same monetary contract limitations as the old system (see footnote b, Table A2.12a) but add more stringent non-monetary requirements for registration. New system was not mandatory when these data were taken.

[b]Local resident contractors of foreign nationality and local branches of international construction firms.

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Table A2.12c: Employment and wages for the construction industry in Ethiopia (source: ref. 8, 9)

Number of firms and year	Number of employees	Wages and salaries (thousand Ethiopian dollars)
For 93 firms[a]		
1966/67	6,844	10,567
1967/68	10,968	15,370
1968/69	8,579	11,200
For 29 large firms[b]		
1966/67	6,145	8,455
1967/68	10,037	12,894
1968/69	7,718	8,838
1969/70	9,074	14,047
1970/71	9,142	14,334

[a] Reference 9.

[b] Account for 90% of the total construction employment, ref. 8.

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Table A2.13a: Number of firms, number engaged, and industrial production for the construction and manufacturing industries in Kenya, for 1963 to 1967 (source: ref. 17)

Industry and year	Number of firms	Number engaged	Output	Gross product[a]
			(thousands of Kenyan pounds)	
Building and construction				
1963	29	5,321	4,419.9	1,726.8
1964	33	4,639	3,792.0	1,294.3
1965	35	5,847	4,699.7	1,497.7
1966	47	9,599	8,057.8	2,722.7
1967	63	13,545	13,997.7	5,020.7
Manufacturing and repairs				
1963	191	46,148	68,660.2	22,931.6
1964	187	47,910	81,859.3	27,368.4
1965	195	48,374	90,317.4	29,918.8
1966	189	50,379	99,516.0	33,507.5
1967	208	51,360	110,350.4	34,235.7

[a]Gross product is the aggregate difference between output and input. It includes labor costs, interest payments, depreciation charges, and net profit before tax.

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Table A2.13b: Summary data from a census of industrial production in Kenya, for 1967 (source: ref. 17)

Industry	Number of establishments	Number of persons engaged	Output	Gross product[a]
			(thousands of Kenyan pounds)	
Building and construction	349	28,704	29,353.6	11,645.9
Private	292	17,249	18,354.8	6,503.3
Public	57	11,455	10,998.8	5,142.6
Mining and quarrying	78	3,185	3,901.5	1,942.4
Manufacturing and repairs	1,043	63,946	134,821.8	41,821.1
Electricity	6	2,492	4,951.1	3,410.5
Total	1,476	98,327	173,028.0	58,819.9

[a]See footnote a in Table A2.13a.

Table A2.13c: Summary data for various industrial groups in Kenya, for 1963 (source: ref. 19)

Industry	Number of establishments	Number of employees	Number of establishments according to number of employees			Gross production	Value added
			5-19	19-49	over 50	(thousands of Kenyan pounds)	
Building and construction	220	29,660	81	72	67	15,502	7,162
Private	146	6,990	60	52	34	5,965	2,732
Public	56	22,142	11	14	31	8,966	4,121
Electrical contracting	18	528	10	6	2	570	308
Mining and quarrying	52	2,638	22	22	8	2,270	1,614
Electricity	9	2,194	-	2	7	5,281	3,433
Manufacturing and repair	775	49,829	417	183	175	74,803	28,580
Total	1,056	84,321	520	279	257	97,856	40,789

Table A2.13d: Size distribution of firms in Kenya, for 1968 (source: ref. 17)

Industry	Number of employees per firm					
	0-4	5-9	10-19	20-49	50 and over	Total
Number of firms by size of firm[a]:						
Building and construction	77	50	72	94	123	416
Agriculture, forestry, fishing	170	238	362	557	745	2,072
Manufacturing and repairs	772	351	235	298	244	1,901
Total[b]	5,980	2,503	1,932	1,977	2,041	14,433
Number of employees by size of firm[c]:						
Building and construction	189	331	1,035	3,014	27,268	31,837
Agriculture, forestry, fishing	472	1,627	5,046	18,290	132,139	157,574
Manufacturing and repair	1,762	2,345	3,307	8,080	54,536	70,030
Total[b]	12,865	16,543	26,600	62,443	393,037	511,488

[a]Refers only to those firms that have responded for the last two years and therefore excludes dormant firms.

[b]In addition to the industries in the table, this includes: mining and quarrying; electricity, gas, and sanitary services; commerce; transport, storage, and communication; services; and activities not adequately described.

[c]The size of firm and number of employees refer almost wholly to the private sector.

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Table A2.14: Output and employment in construction and manufacturing (source: ref. 29)

Country and year		Construction: Statistical units[a]	Construction: Persons engaged[b] (thousands)	Construction: Employees[c] (thousands)	Construction: Wages and salaries[d] (millions of national currency units)	Construction: Value added[e] (millions of national currency units)	Manufacturing: Statistical units[a]	Manufacturing: Persons engaged[b] (thousands)	Manufacturing: Employees[c] (thousands)	Manufacturing: Wages and salaries[d] (millions of national currency units)	Manufacturing: Value added[e] (millions of national currency units)
Ethiopia[f] (dollar)	1958	na	na	na	na	na	133	19.9	19.9	12.5	35.5[g]
	1961	125	na	30.0	17.2	20.3[h]	na	na	na	na	na
	1962	na	na	na	na	na	164	32.6	32.6	21.3	60.8[g]
	1963	na	na	na	na	na	111	na	33.6	22.3	na
Kenya[i] (shilling)	1963	200	na	9.1	104.8	135.0[j]	164	43.4	na	247[k]	431[ℓ]
	1967	291	na	na	200.5	247.7[j]	214	48.7	na	353[k]	634[ℓ]
	1968	416	32.0[m]	31.9[m]	215.7	295.8[j]	232	51.4	na	386[k]	703[ℓ]
	1969	423	28.9[m]	27.0[m]	232.1	395.2[j]	267	55.9	na	437[k]	828[ℓ]
	1970	438	30.8[m]	28.7[m]	308.4	431.6[j]	307	65.4	na	494[k]	962[ℓ]
	1971	425	34.8[m]	24.1[m]	235.2	391.1[j]	na	na	na	na	na
Colombia[n] (peso)	1968	na	na	na	na	na	11,062[o]	302.4[o]	291.4	4,287	18,318
	1969	741	38.1	na	1,106	2,137	7,682[o]	326.6[o]	318.8	5,050	21,754
Iran[p] (rial)	1963	2,364	12.1	8.5	na	15,160	111,992	441.2	290.5	8,900[k]	40,200
	1968	na	na	na	na	30,100	160,378	684.6	462.9	19,100[k]	75,900
Korea[q] (won)	1968	2,591	314.9	na	24,700	55,654	23,808	741.6	715.5	76,600	300,100[r]
	1969	2,626	399.4	397.8	47,796	93,624	24,752	820.1	792.2	105,700	424,200[r]
	1970	2,998	309.6	307.2	52,295	99,649	23,905	854.8	835.3	137,100	547,900[r]
United States[s] (dollar)	1958	na	3.513	2,794	14,025	18,991	303,405	16,209	16,025	78,300	141,500
	1963	na	3,715	2,958	17,802	24,198	293,030	16,313	16,160	93,000	191,600
	1965	na	3,994	3,216	19,446	29,065	na	na	18,105	114,600	227,000
	1967	na	4,012	3,268	24,238	33.223	289,346	na	18,422	123,200	261,300
	1968	na	4,114	3,393	26,985	36,270	na	na	18,610	132,200	284,200
	1969	na	4,323	3,544	30,533	40,862	na	na	19,085	142,200	303,500
	1970	na	4,227	3,481	32,348	42,792	na	na	18,231	140,900	297,400
	1971	na	4,305	3,532	35,000	46,509	na	na	na	na	na

(continued)

(Table A2.14: continued)

[a]Number of entities (i.e., establishments, local units, enterprises, etc.) for which the statistics are compiled.

[b]Average number of all persons engaged during the year, including working proprietors, employees, and unpaid family workers.

[c]Average for the year of number of persons who did work for which they received pay, excluding working proprietors.

[d]All payments made to employees during the year of reference in connection with work done, whether in cash or in kind.

[e]Value added generally represents the "census value added" (i.e., gross of the cost of non-industrial services rendered by others) and is generally given in approximate factor values (i.e., producers' values less all indirect taxes reduced by all subsidies levied on the production of goods and services).

[f]Construction data are for licensed enterprises engaged in contract construction. Manufacturing data include establishments with 5 or more employees except those engaged in flour milling for client's account, coffee and grain cleaning, shoe making, and repairing and tailoring.

[g]Excludes sugar cane grown on plantations of sugar refining enterprises.

[h]At purchaser's value.

[i]Construction data are for establishments with 5 or more employees; manufacturing data include public and private enterprises with 50 or more persons engaged.

[j]Value of gross domestic product.

[k]Including employees' contributions to social security and pension.

[ℓ]Net of the cost of non-industrial services rendered by others.

[m]As of 30 June of the year indicated.

[n]Construction data are for all enterprises. Manufacturing data are for establishments with 5 or more persons engaged or gross value of production of 24,000 pesos or more.

[o]For one period of year indicated.

(continued)

(Table A2.14: continued)

[p]Iran year starts 21 March of year stated. Construction data are for all enterprises. Manufacturing data include all establishments other than those of the Iranian National Oil Company.

[q]Construction data are for all registered units except those of 1968, which are for establishments with 5 or more persons employed. Manufacturing data are for establishments with 5 or more persons engaged excluding government establishments other than railroads, workshops and tobacco factories.

[r]In producers' values.

[s]Construction data include all enterprises engaged in contract construction as of January 1. Manufacturing data are for establishments with at least one employee excluding central administrative offices and auxiliaries serving manufacturing establishments (in all categories in 1963 and 1967-70 and in the persons engaged and value added categores in 1958 and 1965) and excluding those establishments engaged in manufacturing or repairing for the retail trade (in 1958 and 1965).

Table A3.1a: Construction, gross fixed capital formation, and gross capital formation for various developing countries and the U.S.[a] (source: ref. 56)

Country and year		GFCF (million national currency units)	GFCF-C[b] (million national currency units)	GFCF-C as share of GFCF (percent)	GCF (million national currency units)	GFCF-C as share of GCF (percent)	GDP (million national currency units)	GFCF as share of GDP (percent)	GCF as share of GDP (percent)	GFCF-C as share of GDP (percent)
Colombia	1960	4,843	2,698	55.6	5,495	49.0	26,747	18.1	20.5	10.0
(peso)	1963	7,167	4,420	61.6	7,844	56.3	43,525	16.4	18.0	10.1
	1966	12,304	7,468	60.6	15,040	49.6	73,612	16.7	20.4	10.1
	1967	14,729	9,738	66.1	15,341	63.4	83,083	17.7	18.4	11.7
	1968	18,815	11,724	62.1	20,406	57.4	96,422	19.5	21.1	12.1
	1969	21,230	13,873	65.3	22,715	61.0	110,953	19.1	20.4	12.5
	1970	25,850	15,468	59.8	28,130	54.9	130,591	19.7	21.5	11.8
Ethiopia	1963	312	226	72.4	321	70.4	2,499	12.4	12.8	9.0
(dollar)	1966	448	304	67.9	459	66.2	3,370	13.2	13.6	9.0
	1967	511	362	70.8	522	69.3	3,375	15.1	15.4	10.7
	1968	554	363	65.5	565	64.2	3,606	15.3	15.6	10.0
	1969	500	355	71.0	511	69.5	3,861	12.9	13.2	9.1
Kenya	1964	44.3	20.8	47.0	46.6	44.6	355.0	12.5	13.1	5.9
(pound)	1965	45.7	22.1	48.4	51.2	43.2	356.4	12.8	14.4	6.2
	1966	61.2	28.3	46.2	77.4	36.6	415.9	14.7	18.6	6.8
	1967	82.2	40.2	48.9	88.9	45.2	440.2	18.7	20.1	9.1
	1968	89.5	48.4	54.1	92.1	52.6	479.2	18.7	19.2	10.1
	1969	93.7	50.6	54.0	102.2	49.5	519.2	18.0	19.7	9.7
	1970	112.7	55.5	49.2	126.1	44.0	577.8	19.5	21.8	9.6
	1971	140.9	72.6	51.5	163.5	44.4	630.5	22.3	25.9	11.5
Korea	1960	26,500	18,000	67.9	26,800	67.2	244,500	10.8	11.0	7.4
(won)	1963	68,000	41,700	61.3	90,300	46.2	485,200	14.0	18.6	8.6
	1966	208,700	113,600	54.4	224,500	50.6	1,019,100	20.5	22.0	11.1
	1967	27[illegible],000	146,600	53.7	281,000	52.2	1,248,000	21.9	22.5	11.7
	1968	411,700	231,000	56.1	427,900	54.0	1,574,900	26.1	27.1	14.7
	1969	552,900	330,800	59.8	620,700	53.3	2,056,500	26.9	30.2	16.1
	1970	650,700	416,500	64.1	704,700	59.1	2,577,400	25.2	27.3	16.2
	1971	729,700	428,600	58.7	805,300	53.2	3,153,800	23.1	25.5	13.6
United States	1960	85,900	54,700	63.7	89,600	61.0	509,000	16.9	17.6	10.7
(dollar)	1963	99,500	63,700	64.0	105,000	60.7	596,300	16.7	17.6	10.7
	1966	130,300	76,200	58.5	142,200	53.6	758,600	17.2	18.7	10.0
	1967	133,600	78,300	58.6	140,000	55.9	803,600	16.6	17.4	9.7
	1968	146,200	87,700	60.0	154,700	56.7	874,800	16.6	17.6	10.0
	1969	158,600	94,400	59.5	167,200	56.5	942,600	16.8	17.7	10.1
	1970	160,000	95,200	59.5	163,800	58.1	988,600	16.2	16.6	9.6
	1971	178,100	110,700	62.2	181,900	60.9	1,061,900	16.8	17.1	10.4

[a]Data is for the former System of National Accounts (SNA) except for Kenya where it is for the present SNA. All figures are in purchasers' values at current prices except GDP which is in producers' values at current prices, which might result in slightly overstating GFCF, GCF, and GFCF-C as a share of GDP. The following abbreviations are used: GFCF for gross fixed capital formation, GFCF-C for gross fixed capital formation in construction, GCF for gross capital formation, and GDP for gross domestic product.

[b]Includes residential and nonresidential buildings, land improvement, plantation and orchard development, and all other construction.

Table A3.1b: Gross domestic fixed capital formation as a percentage of gross domestic product[a], averages for 1960-1962 and 1966-1968 (source: ref. 39)

Region or country	1960-1962	1966-1968
Developing countries	16.6	17.4
Western hemisphere	18.1	17.7
Colombia	18.1	16.3
Africa	16.2	15.9
Ethiopia[b]	11.9	13.3
Kenya[b]	15.2	14.7
Asia	15.3	17.9
Iran	14.7	18.9
Korea	11.4	24.7
Developed market economies	21.7	24.0
United States	16.6	16.7

[a]Measured at constant 1960 market prices.

[b]Gross domestic capital formation as a percentage of GDP.

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Table A3.1c: Average annual rate of growth of gross fixed capital formation at constant prices, for the periods 1965-1970 and 1960-1970 (percent) (source: ref. 55,56)

Region or country	1965-1970	1960-1970
Market economies	5.9	6.3
Developed market economies	5.5	6.2
Developing market economies	8.1	6.7
Colombia	8.9	4.5
Iran	13.0	12.6
Kenya[a]	15.7	14.9[b]
Korea	29.1	23.5
United States	2.5	4.3[c]

[a]Present SNA; all others are former SNA.

[b]1964-1970.

[c]1960-1971.

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Table A3.2a: Gross domestic savings and gross foreign savings as a percentage of gross domestic product, averges for 1960-1962 and 1966-1968 (source: ref. 39)

Region or country	Gross domestic savings		Gross foreign savings[a]	
	1960-1962	1966-1968	1960-1962	1966-1968
Developing countries	14.7	16.1	1.9	1.4
Western hemisphere	16.5	15.9	1.6	1.2
Colombia	18.0	14.9	2.2	3.8
Africa	12.3	16.5	4.1	-0.3
Ethiopia	10.0	9.1	1.9	4.2
Kenya	11.6	13.3	3.6	1.4
Asia	13.8	16.2	1.5	1.7
Iran	14.9	19.2	-0.2[b]	-0.3[b]
Korea	4.2	18.1	7.6	7.5
Developed market economies	21.6	22.4	1.7	3.0
United States	18.2	18.3	-0.9	-0.5

[a] Difference between gross domestic capital formation and gross domestic savings, expressed as a percentage of GDP.

[b] Difference between gross domestic fixed capital formation and gross domestic savings, expressed as a percentage of GDP.

Table A3.2b: Gross accumulation and its finance for Colombia, Kenya, Korea, and the U.S., former SNA, 1960-1970 (millions of national currency units) (source: ref. 56)

Country and year		Finance of gross accumulation: Total	Saving	Consumption of fixed capital	Net capital transfers from the rest of the world	Gross accumulation: Increase in stocks	Gross fixed capital formation	Other
Colombia (peso)	1960	5,196	2,529	2,667	na	650	4,845	-299[a]
	1963	6,540	2,459	4,081	na	677	7,157	-1,304[a]
	1964	8,011	3,707	4,304	na	948	8,654	-1,591[a]
	1965	10,464	5,468	4,996	na	1,238	9,504	-278[a]
	1966	11,616	5,327	6,289	na	2,737	12,304	-3,425[a]
	1967	14,609	7,498	7,111	na	612	14,729	-732[a]
	1968	17,652	9,522	8,130	na	1,591	18,815	-2,755[a]
	1969	19,430	10,417	9,013	na	1,485	21,230	-3,285[a]
	1970	22,901	12,681	10,220	na	2,280	25,850	-5,229[a]
Kenya[b] (pound)	1964	66.7	54.2[c]	-[c]	12.5	2.3	44.3	20.1[a]
	1965	53.8	48.0[c]	-[c]	5.8	5.5	45.7	2.6[a]
	1966	73.8	70.5[c]	-[c]	3.3	16.2	61.2	-3.6[a]
	1967	70.6	69.6[c]	-[c]	1.0	6.7	82.2	-18.3[a]
	1968	81.3	72.3[c]	-[c]	9.0	2.6	89.5	-10.8[a]
	1969	101.6	93.4[c]	-[c]	8.2	8.5	93.7	-0.6[a]
	1970	110.2	101.1[c]	-[c]	9.1	5.3	114.9	-10.0[a]
Korea (won)	1960	27,900[d]	10,000	12,300	3,600	300	26,500	1,100
	1963	71,200[d]	40,000	26,300	1,200	21,600	68,000	-18,500
	1964	96,000[d]	55,300	36,900	700	20,700	80,500	-5,200
	1965	119,800[d]	69,000	45,700	-[e]	800	117,600	1,300
	1966	195,100[d]	123,000	57,900	-[e]	17,100	206,000	-28,000
	1967	220,300[d]	123,800	73,800	-[e]	8,200	264,000	-51,900

(continued)

(Table A3.2b continued)

Country and year		Finance of gross accumulation: Total	Saving	Consumption of fixed capital	Net capital transfers from the rest of the world	Gross accumulation: Increase in stocks	Gross fixed capital formation	Other
(Korea, cont.)	1968	299,500[d]	171,400	99,700	-[e]	19,000	402,300	-121,800
	1969	456,500[d]	297,200	126,200	-[e]	67,300	547,300	-158,200
	1970	519,000[d]	316,600	156,800	-[e]	60,700	651,700	-193,300
United States (dollar)	1960	91,300[d]	43,200	49,100[f]	-[e]	3,700[g]	85,900[h]	1,700
	1963	108,100[d]	49,200	59,200[f]	-[e]	5,500[g]	99,500[h]	3,100
	1964	118,600[d]	56,300	63,600[f]	-[e]	4,900[g]	108,000[h]	5,700
	1965	132,600[d]	67,700	67,900[f]	-[e]	8,500[g]	120,000[h]	4,100
	1966	144,700[d]	72,400	73,300[f]	-[e]	12,000[g]	130,300[h]	2,400
	1967	142,700[d]	64,100	79,200[f]	-[e]	6,900[g]	133,600[h]	2,200
	1968	154,300[d]	71,600	85,400[f]	-[e]	8,400[g]	146,200[h]	-400
	1969	165,200[d]	76,500	92,800[f]	-[e]	8,100[g]	157,900[h]	-900
	1970	163,500[d]	68,200	98,800[f]	900	1,700[g]	160,500[h]	1,300

[a] Some of data going into this is not available.

[b] Present SNA.

[c] Saving includes consumption of fixed capital.

[d] Includes a statistical discrepancy.

[e] Less than 50 million national currency units.

[f] Capital consumption estimates for private non farm enterprises are valued at original costs, agricultural estimates are valued at replacement costs, and government capital consumption is equal to civil new public construction plus net purchase of used structures by government.

[g] Includes change in stock of federal government enterprises and stockpiling of strategic materials.

[h] Includes civil new public construction and net purchases of used structures by government.

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Table A3.3: Sources of saving in Korea and the United States, 1960-1970, former SNA (source: ref. 56)

Country and year		Savings of corporate and quasi-corporate enterprises		Savings of general government		Savings of households[a]	
		(billions of national currency units)	(percent of total saving)	(billions of national currency units)	(percent of total saving)	(billions of national currency units)	(percent of total saving)
Korea	1960	2.6	26.0	10.1	101.0	-2.6	-26.0
(won)	1963	12.6	31.5	21.2	53.0	6.1	15.3
	1964	13.0	23.5	31.3	56.6	11.1	20.1
	1965	20.7	30.0	46.0	66.7	2.3	3.3
	1966	23.6	19.2	57.4	46.7	42.0	34.1
	1967	29.8	24.1	82.3	66.5	11.7	9.5
	1968	30.3	17.7	125.9	73.5	15.3	8.9
	1969	32.4	10.9	150.3	50.6	114.4	38.5
	1970	37.3	11.8	195.1	61.6	84.2	26.6
U.S.	1967	24.1	37.6	-4.4	-6.9	44.4	69.3
(dollar)	1968	20.9	29.2	6.8	9.5	43.9	61.3
	1969	14.5	19.0	19.4	25.4	42.6	55.7
	1970	11.7	17.2	-2.3	-3.4	58.9	86.4

[a]Includes private non-profit institutions serving households.

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Table A3.4: Rates of discount[a] of central banks in a few developing countries and the U.S. (percent per annum) (source: ref. 55)

Country and date of rate change		Rate
Colombia	May 1963	8.00
	March 1970	14.00[b]
Iran	October 1963	4.00
	August 1966	5.00
	November 1968	7.00
	August 1969	8.00
	October 1971	7.00
Korea	June 1960	10.22
	March 1964	10.50
	November 1965	21.00
	December 1965	28.00
	March 1968	21.00
	October 1968	23.00
	June 1969	22.00
	April 1970	21.00
	December 1970	19.00
	June 1971	16.00
United States[c]	July 1963	3.50
	November 1964	4.00
	December 1965	4.50
	April 1967	4.00
	November 1967	4.50
	March 1968	5.00
	April 1968	5.50
	August 1968	5.25
	December 1968	5.50
	April 1969	6.00
	November 1970	5.75
	December 1970	5.50
	January 1971[d]	5.00
	February 1971	4.75
	July 1971	5.00
	November 1971	4.75
	December 1971	4.50

[a]Rates shown represent those rates at which the central bank either discounts or makes advances against eligible commercial paper and/or government securities for commercial banks or brokers. For countries with more than one rate applicable to such discounts or advances, the rate shown is the one at which the largest proportion of central bank credit operations is understood to be transacted. The most recent rate shown for each country is that which was still effective on December 31, 1971.

[b]Period average.

[c]Data for Federal Reserve Bank of New York only.

[d]End of period.

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Table A3.5: Net flow of financial resources from multilateral agencies to developing countries, 1961-1971 (millions of dollars) (source: ref. 64)

Multilateral agency	Average annual net flow			
	1961-1963	1964-1966	1967-1969	1970-1971[a]
World Bank	262.0	318.3	363.0	598.5
IDA	43.7	232.3	277.7	225.0
IFC	10.3	15.0	31.0	62.0
Total Bank Group[b]	316.0	565.7	671.7	885.5
Inter-American Development Bank	68.7	182.7	248.3	351.0
Asian Development Bank	-	-	4.0[c]	45.0
African Development Bank	-	-	1.0[d]	6.5
European Development Fund	44.7	115.0	150.3	181.0
United Nations Development Program[e]	67.5[f]	108.0	164.3	217.0

[a] Based partly on 1971 figures which are provisional.

[b] Only loans to IDA Part II countries are included.

[c] 1968-1969 average.

[d] 1969 only.

[e] UNDP program costs in projects; there are no repayments in UNDP assistance.

[f] 1962-1963 average.

Table A3.6a: Proportion of official commitments from some of the DAC countries to less developed countries and international institutions in the form of grants[a], 1964-1969 (percentage) (source: ref. 39)

Country	1964	1965	1966	1967	1968	1969
Norway	95	96	100	100	92	91
France	80	80	83	74	71	75
Japan	51	37	42	38[b]	57[b]	20
Denmark	77	70	63	64	57	78
Austria[c]	21	18	26	29	51	54
United Kingdom	54	55	50	57	46	48
United States	58	62	61	56	45	60
Portugal[b]	18	27	19	19	21	17
Average, DAC countries	60	61	62	56	51	55

[a]Less developed countries are the developing countries plus Cyprus, Greece, Malta, Spain, Turkey, and Yugoslavia. Grants include sales of commodities for recipients' currencies.

[b]Official development assistance only.

[c]Loans calculated partly on a gross disbursements basis.

Table A3.6b: Weighted average rate of interest on official loan commitments from some of the DAC countries to less developed countries, 1964-1969 (percentage per annum) (source: ref. 39)

Country	1964	1965	1966	1967	1968	1969[a]
Denmark	4.0	5.3	0.0	0.0	0.0	0.0
United Kingdom	4.1	3.3	1.0	1.1	1.0	1.2
Norway	4.5	3.0	-[b]	-[b]	2.2	1.7
United States	2.5	3.3	3.0	3.6	3.6(2.6)	3.0
France	3.2	3.7	3.5	3.7	3.7	3.7
Japan	5.8	4.4	5.2	4.8	3.7	3.7
Austria	5.2	5.5	5.4	5.2	5.1(3.2)	2.6
Portugal	4.1	3.8	3.6	4.8	5.6(2.4)	2.3
Average, DAC countries	3.1	3.6	3.1	3.8	3.6(2.7)	2.9

[a]Calculated on the basis of official development assistance commitments only, as are the figure in parentheses for 1968.

[b]Commitments were in grant form.

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Table A3.6c: Weighted average maturity of official loan commitments from some of the DAC countries to less developed countries, 1964-1969 (years) (source: ref. 39)

Country	1964	1965	1966	1967	1968	1969[a]
United States	33.4	27.9	29.3	28.2	30.0(38.0)	37.1
Denmark	19.1	13.7	18.7	24.0	24.9	25.0
United Kingdom	24.0	22.2	23.9	24.1	24.0	24.1
Norway	17.0	16.0	-[b]	-[b]	23.0	36.0
Portugal	16.3	21.5	25.4	16.2	22.6(31.7)	30.1
Japan	16.0	12.0	14.1	16.6	18.1(17.9)	19.5
France	15.6	16.8	15.3	15.1	17.6	17.0
Austria	8.8	7.7	9.4	14.6	16.8(21.9)	27.2
Average, DAC countries	28.6	22.6	25.1	24.0	26.0(30.7)	28.4

[a] Calculated on the basis of official development assistance commitments only, as are the figures in parentheses for 1968.

[b] Commitments were in grant form.

Table A3.6d: Weighted average grace period on official loan commitments from some of the DAC countries to less developed countries, 1964-1969 (years) (source: ref. 39)

Country	1964	1965	1966	1967	1968	1969[a]
United States	7.7	5.9	6.6	6.7	7.0(9.0)	8.7
Denmark	5.5	2.4	4.2	6.6	7.0	8.7
United Kingdom	5.1	4.8	6.0	5.5	5.6	5.6
Norway	6.0	6.0	-[b]	-[b]	5.5	7.9
Japan	4.5	2.4	4.5	4.7	5.5(5.6)	6.1
Portugal	1.4	3.8	4.1	2.2	5.5(8.4)	8.0
Austria	1.4	0.9	2.0	3.7	1.9	4.2
France	3.1	2.8	2.4	1.8	1.7	1.9
Average, DAC countries	6.5	4.6	5.8	5.5	6.0(7.2)	6.7

[a]Based on official development assistance commitments only, as are the figures in parentheses for 1968.

[b]Commitments were in grant form.

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Table A3.7: IBRD loans and IDA credits by country, net as of June 30, 1971[a] (source: ref. 27)

Source	Colombia	Ethiopia	Kenya[b]	Korea	Iran
Bank Loans					
Number	48	11	12	6	19
Amount (dollars)	871,877,840	97,800,000	228,824,026	194,500,000	612,146,457
IDA Credits					
Number	1	6	11	6	-
Amount (dollars)	19,500,000	44,500,000	61,300,000	64,938,129	-
Total					
Number	49	17	23	12	19
Amount(dollars)	891,377,840	142,300,000	290,124,026	259,438,129	612,146,457

[a] Initial commitments net of cancellations, refundings, and terminations.

[b] Six loans aggregating $162.8 million shown against Kenya are shared with Tanzania and Uganda.

Table A3.8a: Distribution of the economically active population by occupational group (source: ref. 22)

Country and year		Economically active population (number)	Percentage distribution by occupational group												
			0	1	2	3	4	5	6	7	8	9	10	11	12
Colombia	1964	5,134,125	3.9	2.6	4.6	5.6	47.4	0.8	3.0	17.4	11.2	-	3.5	-	-
	1951	3,755,609	2.3	-[a]	8.1[a]	1.7	53.1	1.3	1.9	17.2	10.6	1.0	2.8	-	-
Iran	1966	7,584,085	2.7	0.1	2.7	6.7	41.3	-[b]	-[b]	26.8[b]	6.7	-[c]	3.4[c]	-[d]	9.6[d]
	1956	6,066,643	1.6	0.5	2.5	5.7	54.0	0.9	2.3	19.9	7.5	0.8	1.7	-	2.6
Korea[e]	1972	10,500,000	3.1	0.4	6.1	11.1	48.5	-[b]	-[b]	19.7[b]	6.6	-	-	-	4.5
	1966	8,654,360	2.6	0.8	3.9	9.8	52.4	0.7	1.3	15.6	4.9	-	-	-	8.0
	1960	7,543,060	2.2	1.2	2.5	7.8	61.8	0.6	3.0	9.0	4.8	1.0	1.6	-	4.5
U.S.	1972	88,991,000	13.2	9.2	16.8	6.3	3.5	-[b]	-[b]	34.2[b]	13.2	2.8	-	0.8	-
	1966	80,164,000	11.8	9.3	15.2	6.1	4.9	-[f]	18.1[f]	17.3	12.7	3.9	-	0.7	-
	1960	69,877,476	10.8	7.9	13.0	7.4	6.1	0.5	4.6	31.4	10.7	2.5	4.9	0.2	-

Note: Occupational groups are as follows:

0 - Professional, technical, and related workers
1 - Administrative, executive, and managerial workers
2 - Clerical workers
3 - Sales workers
4 - Farmers, fishermen, hunters, loggers, and related workers
5 - Miners, quarreymen, and related workers
6 - Workers in transport and communications
7 - Craftsmen, production process workers, and laborers not elsewhere classified
8 - Service, sport, and recreation workers
9 - Armed services members
10 - Workers not classifiable by occupation (may include some unemployed)
11 - Persons seeking work for the first time
12 - Unemployed (used when unemployed are not classified according to the occupation in which they are usually or were most recently engaged)

(continued)

(Table A3.8a continued)

[a] Category 1 included in 2.

[b] Categories 5 and 6 included in 7.

[c] Category 9 included in 10.

[d] Category 11 included in 12.

[e] For 1966 and 1972, economically active population figures do not include categories 9 and 11. For 1960, military persons in barracks and 24,945 persons of unknown status are excluded.

[f] Category 5 included in 6.

Table A3.8b: Unemployment for occupational groups as a percentage of total unemployment[a] in Korea and the U.S. (source: ref. 22,43,63)

Country and year		Total unemployment (thousands)	Percentage distribution by occupational group							
			0	1	2	3	4	5+6+7	8	10+11
Korea	1972	474	1.5	0.4	6.5	9.3	4.6	31.2	3.4	43.0
	1971	457	1.5	0.4	6.3	7.2	5.5	18.6	3.9	56.5
	1970	446	1.3	0.2	5.6	4.9	7.2	16.8	2.9	61.0
	1969	471	0.6	0.6	2.8	4.5	6.2	19.3	2.5	63.5
	1968	496	1.4	1.8	3.2	6.5	7.5	17.7	3.0	58.9
	1967	590	0.8	1.5	4.4	6.4	7.1	16.4	3.6	59.7
	1966	666	0.9	1.1	2.7	5.7	9.3	12.5	0.6	67.3
	1965	677	1.9	1.0	4.9	5.2	8.0	16.2	3.7	59.1
United States	1972	4840	5.8	3.0	14.5	4.9	1.7	40.8	15.2	14.0[b]
	1971	4993	6.7	2.9	13.7	4.5	1.6	43.6	14.4	12.6[b]
	1970	4088	5.6	2.7	14.2	4.8	2.0	45.1	13.2	12.4[b]
	1969	2831	5.1	2.7	14.8	4.9	2.2	40.8	14.8	14.6[b]
	1968	2817	4.5	2.7	13.9	4.7	2.6	41.7	15.5	14.5[b]
	1967	2975	4.5	2.3	13.4	5.1	2.9	42.6	14.8	14.5[b]
	1966	2875	4.3	2.6	12.1	4.6	2.8	41.5	15.5	16.6[b]
	1965	3366	4.0	2.5	11.1	4.8	3.3	43.4	14.9	16.1[b]
	1964	3786	3.9	2.7	10.8	4.1	3.6	45.3	14.9	14.7[b]
	1963	4070	3.8	2.7	10.6	4.6	3.3	47.7	13.9	13.4[b]

Note: See Note in Table A3.8a for explanation of occupational categories.

[a] Unemployment includes persons seeking work whether or not they were previously employed and persons available for work who were previously employed, including persons temporarily laid off.

[b] Category 11 only.

Table A3.9: Range of average number of man-hours for construction of one thousand square feet of dwelling in Europe and the United States[a] (source: ref. 62)

Type of construction	Walkup apartments		Elevator apartments	
	Off-site	On-site	Off-site	On-site
Europe				
Housing built by industrialized systems	200-450	350-2100[b]	200-350	300-1850[b]
Housing of comparable rating built conventionally	-	1750-2600[b]	-	1750-2900[b]
United States				
Housing built conventionally	na	na	-	850-1486

[a]Source (dated 1970) gives no year.

[b]High figures are reported from Great Britain.

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Table A3.10: Ratio of the number of technical and administrative employees to the total number of workers employed in the building industry for various developed countries (source: ref. 38)

Country and year	Ratio (percent)
Sweden (1960)	23.5
Eastern Germany (1963)	22.5
Poland (1964)	21.0
Norway (1960)	20.0
Netherlands (1960)	20.0
Czechoslovakia (1964)	18.2
Austria (1951)	18.0
Federal Republic of Germany (1950)	18.0
United Kingdom (1951)	18.0
Hungary (1964)	17.0
USSR (1964)	15.0
United States (1962)	14.0

Table A3.11a: Fixed capital formation in construction in Korea, 1953-1965, and fixed asset formation and stock in construction in Mexico, 1950-1967 (source: ref. 9,42)

Country and nature of investment	1950	1952	1954	1956	1958	1960	1962	1964	1966	1967
Korea[a]										
Gross domestic fixed capital formation:										
Total (billion won)	na	3.28[b]	5.86	14.99	19.80	25.42	45.30	71.26	95.28[c]	na
Construction (billion won)	na	0.01[b]	0.02	0.11	0.26	0.22	1.59	1.03	1.59[c]	na
(percent of total)	na	0.3[b]	0.3	0.7	1.3	0.8	3.5	1.4	1.6[c]	na
Mexico[d]										
Gross fixed asset formation:										
Total (million pesos)	13,572	18,329	17,444	22,285	22,271	25,507	26,887	37,041	43,143	48,710
By type of activity										
Construction (million pesos)	68	240	123	146	234	291	80	221	138	71
(percent of total)	0.5	1.3	0.7	0.7	1.1	1.1	0.3	0.6	0.3	0.1
By goods produced										
Construction (million pesos)	7,456	10,291	9,422	12,050	12,124	14,043	14,796	19,755	22,308	25,118
(percent of total)	54.9	56.1	54.0	54.1	54.4	55.1	55.0	53.3	51.7	51.6
Stock of fixed assets:										
Total (million pesos)	232,139	259,208	282,746	312,656	345,561	379,424	477,193	467,089	528,966	566,607
By type of activity										
Construction (million pesos)	866	1,156	1,283	1,467	1,953	2,312	2,297	2,551	2,823	2,824
(percent of total)	0.37	0.45	0.45	0.47	0.57	0.61	0.55	0.55	0.53	0.50

[a]At current market prices, ref. 42.

[b]Figures are for 1953.

[c]Figures are for 1965, preliminary.

[d]In constant 1960 pesos, ref. 9.

Table A3.11b: Assets of corporate firms in contract construction and various other industries, in the U.S., 1965 (source: ref. 2)

Industry	Number of firms	Total assets (millions of dollars)	Assets per firm (dollars)
All industries	1,427,606	1,736,349	1,316,000
Agriculture	27,582	6,765	245,000
Mining	13,326	19,560	1,468,000
Construction	113,403	26,794	236,000
Manufacturing	186,613	372,583	1,997,000
Transportation and utilities	59,846	187,390	3,131,000
Trade	441,538	126,945	2,875,000
Finance, insurance, and real estate	389,634	965,042	2,477,000
Services	188,284	33,727	179,000

Table A3.12: Construction materials supplied by government to private contractors in Korea, 1966-1970 (source: ref. 12)

Year and amount	Cement (thousand bags)		Steel reinforcement bars (thousand kilograms)		Timber (thousand cubic meters)	
	Government	Contractors	Government	Contractors	Government	Contractors
1966						
Quantity	7,837	8,534	57,706	96,406	53	304
Percent	48.2	51.8	37.5	62.5	14.8	85.2
1967						
Quantity	9,234	12,425	55,802	86,837	27	347
Percent	43	57	37	63	17	83
1968						
Quantity	21,139	21,483	104,931	118,706	29	401
Percent	49	51	48	52	7	93
1969						
Quantity	24,201	22,222	155,168	124,572	31	455
Percent	52	48	55	45	6	94
1970						
Quantity	24,386	23,599	160,630	165,626	46	840
Percent	50.8	49.2	49.2	50.8	5.2	94.8

Table A3.13: Heavy equipment available to the construction industry in Korea in 1971 (source: ref. 12)

Type of equipment	Government	Contractors	Total
Bulldozers	578	1538	2116
Loaders	97	1202	1299
Motor graders	107	155	262
Cranes	38	578	616
Rock crushers	15	139	154
Motor scrapers	32	307	339
Dump trucks	238	652	890
Air compressors	64	437	501
Pay loaders	170	499	669
Concrete mixers	8	706	714
Compacting machines	60	214	264
Miscellaneous	137	417	554
Total	1534	6844	8378

Table A3.14: Occupational distribution of applicants on the live register of the employment exchanges in India at the end of December 1964 (source: ref. 20)

Occupational class	Percentage of total[a]
Professional, technical, and related workers	4.4
Administrative, executive, and managerial workers	0.1
Clerical, sales, and related workers	2.8
Agricultural, dairy, and related workers	0.4
Miners, quarrymen, and related workers	0.2
Workers in transport and communications operations	1.9
Craftsmen and production process workers	6.6
Service workers (e.g. cooks, sweepers, etc.)	3.4
Laborers with work experience not elsewhere classified	4.7
Persons without professional or vocational training or previous work experience	75.5

[a]Total number of applicants is 2,489,102.

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TableA3.15: Adult literacy rates[a] for Colombia, Iran, Korea, Kenya, Ethiopia, and the United States (source: ref. 39,54)

Country and year		Literate		Illiterate	
		Number	Percent	Number	Percent
Colombia	1951[b]	4,020,921	62.3	2,429,333	37.7
	1964	6,802,389	72.9	2,526,590	27.1
Iran	1956	1,397,037	12.8	9,522,949	87.2
	1966[c]	3,077,588	22.8	10,407,726	77.0
Korea	1955[d]	9,702,976	76.8	2,934,353	23.2
	1960[e]	11,486,328	72.1	4,454,004	27.9
	1966[f]	11,223,120	68.1	5,252,600	31.9
Kenya - early 1960's		na	22	na	78
Ethiopia - early 1960's		na	5	na	95
United States[g]	1950[h]	108,080,400	96.9	3,623,000	3.2
	1959[i]	118,754,000	97.8	2,619,000	2.2

[a]Based on census statistics of population aged 15 and over (Kenya and Ethiopia - ref. 39 ; all other - ref. 54.

[b]Excludes adjustments for undernumeration (estimated at 191,683 people) and also excludes indigenous population of 127,980.

[c]For settled population only (unsettled population estimated at 244,141 and nomadic tribes at 462,146). The literacy of 33,280 (0.2%) of those included is unknown.

[d]Semi-literate population is included in literate category. Includes only Korean nationals.

[e]Ages 13 and over. Excludes alien armed forces, civilian aliens employed by armed forces, and foreign diplomatic personnel and their dependents.

[f]De jure population. Excludes alien armed forces, civilian aliens employed by armed forces, and foreign diplomatic personnel and their dependents.

[g]Age 14 and over. Excludes Alaska and Hawaii.

[h]Based on a twenty percent sample of census returns. De jure population excluding armed forces overseas (estimated at 435,000).

[i]Estimates based on sample surveys. Relates to civilian population excluding inmates of institutions.

Table A3.16a: Estimated calorie and protein content of per capita average daily food supply, 1960 and 1967, for Colombia, Kenya, Ethiopia, Iran, Korea, and the United States (source: ref. 16,39)

	Colombia	Ethiopia	Kenya	Iran	Korea	U.S.
Assumed requirements per person per day[a]:						
Calories	2400	na	2270	2330	2200	2710
Protein (g.)	66	na	63	62	56	74
Per capita average daily food supply:						
Calories - around 1960	2370	2040	2120	2050	2090	3120
- around 1967	2280	na	2240	1950	2430	3240
% of requirement[a]	95	na	99	84	111	120
Protein - around 1960 (g.)	55.6	na	64.4	59.6	59.0	92.4
- around 1967 (g.)	53.3	na	67.9	52.1	69.5	96.1
% of requirement[a]	81	na	108	84	124	129

[a]FAO/WHO reference standards of physiological needs of various subregions. Percentage is calculated on 1967 data.

Table A3.16b: Per capita calorie and protein intake by income class for various developing countries (source: ref. 36)

Country, year, and family income/ expenditure group	Percentage of families	Per capita calorie intake (calories)	Per capita protein intake (grams) Total	Animal
LATIN AMERICA				
Brazil (1960-61) Annual family income (new cruzeiros per year)				
Urban areas:				
Under 100	4.16	1,315	35.6	10.5
100-249	21.94	1,788	49.1	15.1
250-499	31.48	2,227	66.9	25.6
500-1,199	30.54	2,830	95.7	40.1
1,200 & over	11.88	3,569	119.9	65.1
Average	--	2,345	73.2	31.2
Rural areas:				
Under 100	7.94	1,755	50.0	13.2
100-249	27.30	2,267	64.9	21.7
250-499	29.68	2,577	75.9	na
500-1,199	24.56	3,144	95.4	39.1
1,200 & over	10.52	3,674	116.6	52.5
Average	--	2,083	80.6	31.0
Colombia (1956-62)				
"Very poor" rural	na	1,535	30	9
"Very poor" urban	na	1,538	34	15
"Middle class" rural	na	2,138	52	22
"Middle class" urban	na	2,183	60	31
Mexico (1958/59)				
"Very poor" rural	na	1,788	45	na
"Very poor" urban	na	1,803	51	na
"Middle class" rural	na	2,275	57	na
"Middle class" urban	na	2,331	64	na
Peru (1951-58)				
Mountain area	na	1,754	47	na
Coastal areas	na	2,205	64	na
ASIA				
Ceylon				
Rural (1961-66)	na	1,864	44	8.3
Upper class Colombo (1957)	na	3,271	84	na

(continued)

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(Table A3.16b continued)

Country, year, and family income/ expenditure group	Percentage of families	Per capita calorie intake (calories)	Per capita protein intake (grams)	
			Total	Animal
Iran[a]				
Peasants	na	1,842	60	na
Urban wage earners	na	2,132	65	na
Landowners	na	2,658	74	na
India (1958)				
Maharashtra State				
Expenditure per capita (rupees)				
Urban and rural areas:				
0 - 11	21.3	1,340	37.9	1.4
11 - 18	18.9	2,020	56.6	2.6
18 - 34	20.7	2,485	69.0	6.6
34 and over	39.1	3,340	85.7	11.9
Average	--	2,100	59.7	4.5
AFRICA				
Madagascar (1962)				
Income (thousand francs per family per year):				
1 - 20	54.7	2,154	47.3	5.5
20 - 40	27.7	2,292	54.1	8.5
40 - 80	11.0	2,256	53.6	9.4
80 - 130	3.8	2,359	61.2	15.2
130 - 190	1.5	2,350	59.1	15.2
190 - 390	0.8	2,342	64.6	21.8
390 - 590	0.3	2,456	65.4	23.6
Other classes	0.2	na	na	na
UAR (1965)				
Low income class	na	2,204	71	15.0
Middle income class	na	2,818	84	18.0
Higher income class	na	3,130	98	37.0
Tunisia (1965-67)				
Dinars per person				
Rural areas:				
Less than 20	8.2	1,782	na	na
20 - 32	16.2	2,157	na	na
32 - 53	30.8	2,525	na	na
53 - 102	32.4	2,825	na	na

[a]Original source dated 1961.

(continued)

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(Table A3.16b continued)

Country, year, and family income/ expenditure group	Percentage of families	Per capita calorie intake (calories)	Per capita protein intake (grams)	
			Total	Animal
102 - 200	10.9	3,215	na	na
200 and over	1.5	3,150	na	na
Average	--	2,609	na	na

Table A3.17a: Ratios of active apprentices, apprenticeship completions, and journeymen losses to active journeymen, by craft for 52 major cities in the U.S. (source: ref. 28)

Occupation	Average ratio of apprentices per 100 active journeymen[a]		Apprenticeship completions per 1000 active journeymen[b]		Journeymen losses per 1000 active journeymen[c]	
	1950-1964	1965-1968	1950-1964	1965-1968	1950-1964	1965-1968
Asbestos workers	na	20.5	na	41.5	na	27.2
Bricklayers, marble, terrazzo, mosaic, stone, and tile workers	7.4	5.3	25.7	10.8	19.7	19.5
Carpenters (including soft floor layers and millwrights)	4.3	4.4	7.2	4.8	15.7	14.2
Electricians	13.2	12.4	32.0	27.3	20.6	28.0
Ironworkers (including rodmen)	5.0	6.3	16.7	15.5	21.5	23.0
Lathers	na	7.0	na	18.2	na	26.0
Painters, glaziers, and paperhangers	3.3	4.2	7.9	8.8	22.6	24.2
Plasterers and cement masons	6.8	4.3	19.3	9.0	21.4	20.5
Plumbers and pipefitters	10.2	11.3	19.3	16.0	20.8	23.5
Roofers	12.3	12.7	33.3	28.2	29.0	32.0
Sheet metalworkers	12.7	12.7	27.9	25.2	15.5	17.2

[a]Ratio of number of persons working under apprenticeship agreements to number of journeymen working or available for work on July 1 of the specified year.

[b]Ratio of number of persons completing prescribed apprentice training during the previous twelve months to the number of active journeymen on July 1 of the specified year

[c]Ratio of number of journeymen who became unavailable for work because of death, permanent disability, or retirement during the previous twelve months to the number of journeymen active on July 1 of the specified year.

Table A3.17b: Ratio of apprentices to craftsmen (excluding electricians) employed by contractors in the construction industry, by craft for Great Britain, 1962 (source: ref. 3)

Occupation	Craftsmen (thousands)	Apprentices (thousands)	Ratio of apprentices per 100 craftsmen
Carpenters and joiners	143.0	29.0	20
Bricklayers	95.7	13.3	14
Slaters and tilers	10.5	1.5	14
Plasterers	26.5	3.5	13
Painters	116.0	14.0	12
Plumbers and glaziers	44.3	12.7	29
Masons	7.0	1.0	14
Heating and ventilating engineers	19.8	3.2	16
Total	462.8	78.2	17

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Table A3.18a: Enrollment in educational institutions in Korea and Iran, 1961-1971 (thousands)(source: ref. 43)

Country and year		Pre-school	First level	Second level: General	Second level: Vocational or technical	Second level: Teacher training	Second level: Total	Third level	Special
Korea	1961	15	3855	789	119	10	928	142	na
	1962	17	4089	855	142	3	999	134	1
	1963	19	4422	880	169	-	1049	132	2
	1964	17	4726	904	182	-	1085	143	2
	1965	20	4941	1005	196	-	1201	142	3
	1966	22	5165	1082	198	-	1280	175	3
	1967	22	5383	1171	209	-	1380	171	3
	1968	22	5549	1287	223	-	1510	172	4
	1969	22	5623	1442	271	-	1712	187	3
	1970	22	5749	na	na	na	1935	201	4
	1971	22	5807	na	na	na	na	215	5
Iran	1961	13.1	1554.5	300.9	9.1	7.5	314.2	22.8	na
	1962	12.9	1719.4	326.9	9.2	5.8	341.9	24.3	na
	1963	13.3	1841.2	369.7	10.5	3.8	383.3	24.9	na
	1964	13.6	2030.7	426.4	12.9	4.2	443.5	25.7	na
	1965	13.7	2181.7	493.7	15.2	4.7	561.2	29.0	1.4
	1966	14.7	2378.1	579.8	16.0	5.7	658.5	36.7	na
	1967	15.2	2575.6	674.6	16.2	6.7	690.8	46.9	1.4
	1968	19.5	2753.1	781.6	19.0	6.0	806.6	58.1	1.4
	1969	20.2	2916.2	897.4	23.3	9.3	930.0	67.3	2.1
	1970	19.3	3002.8	969.2	30.5	13.2	1012.9	74.7	na

Table A3.18b: Enrollment and output[a] of educational institutions in Colombia (source: ref. 21)

Educational level	1960		1964		1968	
	Enrollment	Output	Enrollment	Output	Enrollment	Output
Primary	1,960,000	na	na	na	2,733,000	na
Secondary	251,000	na	390,000	na	587,000	na
Bachilerato	140,000	8,070	236,000	13,902	406,000	23,728
Industrial	12,000	199	16,000	445	28,000	1,223
Commercial	40,000	725	50,000	873	69,000	1,200
Agricultural	3,000	90	3,000	92	8,000	220
Teacher training	28,000	2,099	52,000	2,706	54,000	7,095
Vocational	8,000	450	11,000	529	12,000	675
Other	19,000	na	23,000	na	11,000	na
Higher	24,000	na	na	na	62,000	na
Total	2,235,000	na	na	na	3,382,000	na

[a] Although the source does not define output, presumably it represents the number of students who completed a particular level of education in the year indicated. Colombia's high dropout rate (e.g., only 5.3% of the students who enrolled in agricultural schools in 1963 completed the course in 1968) and the large number of students who repeat a year's work (e.g., nearly 18% of all students enrolled in primary level schools in 1968 were repeaters) may explain the seemingly disproportionate figures for enrollment and output.

Table A3.19a: Gross domestic product per employee and gross domestic product per economically active person in U.S. dollars for construction, manufacturing, agriculture, and total economy for Korea, Kenya, and the U.S. (source: ref. 22,54,55)

Industry, country and year		Total GDP (former SNA, million US dollars)	Sector's share of GDP (percent)	Sector's share of GDP (million US dollars)	Employment in sector (thousands)	GDP per employee (thousand US dollars per person)	Economically active population in sector (thousands)	GDP per economically active person (thousand US dollars per person)
CONSTRUCTION								
Korea	1970	8,281	6	496.9	279[a]	1.8	na	na
	1969	7,085	6	425.1	333[a]	1.3	na	na
	1968	5,685	5	284.3	317[a]	0.9	340	0.8
	1963	3,732	3	112.0	200[a]	0.6	200	0.6
Kenya	1970	1,618[b]	6[b]	97.1	30.8[c]	3.2	na	na
	1969	1,454[b]	6[b]	87.2	28.9[c]	3.0	na	na
	1968	1,344[b]	5[b]	67.2	31.9[c]	2.1	na	na
	1964	924	4	37.0	22.0[c]	1.7	na	na
United States	1971	1,045,753[b]	5[b]	52,288	3,411[d]	15.3	5,447	9.6
	1970	972,581[b]	5[b]	48,629	3,381[d]	14.4	4,572	10.6
	1969	927,876[b]	5[b]	46,393	3,435[d]	13.5	5,061	9.2
	1968	862,700	5	43,135	3,285[d]	13.1	4,887	8.8
	1967	799,300	5	39,965	3,208[d]	12.5	4,807	8.3
	1966	752,300	4	30,092	3,275[d]	9.2	4,924	6.1
	1965	558,700[e]	5	27,935	3,186[d]	8.8	na	na
	1963	596,341	4	23,853	2,963[d]	8.1	na	na
	1960	509,028	4	20,361	na	na	4,302	4.7
MANUFACTURING								
Korea	1970	8,281	21	1,739.0	1,260[a]	1.38	na	na
	1969	7,085	21	1,487.9	1,222[a]	1.22	na	na
	1968	5,685	20	1,137.0	1,181[a]	0.96	1,231	0.92
	1963	3,732	15	559.8	631[a]	0.89	631	0.89
Kenya	1970	1,618[b]	12[b]	194.2	82.3[c]	2.36	na	na
	1969	1,454[b]	11[b]	159.9	72.7[c]	2.20	na	na

(continued)

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(Table A3.19a continued)

Industry, country and year		Total GDP (former SNA, million US dollars)	Sector's share of GDP (percent)	Sector's share of GDP (million US dollars)	Employment in sector (thousands)	GDP per employee (thousand US dollars per person)	Economically active population in sector (thousands)	GDP per economically active person (thousand US dollars per person)
(Manufacturing, cont.)								
(Kenya)	1968	1,344[b]	11[b]	147.8	70.7[c]	2.09	na	na
	1964	924	10	92.4	60.8[c]	1.52	na	na
United States	1971	1,045,753[b]	25[b]	261,438	18,529[d]	14.1	20,972	12.5
	1970	972,581[b]	26[b]	252,871	19,349[d]	13.1	20,837	12.1
	1969	927,876[b]	28[b]	259,805	20,167[d]	12.9	21,964	11.8
	1968	862,700	28	241,556	19,781[d]	12.2	21,555	11.2
	1967	799,300	28	223,804	19,447[d]	11.5	21,472	10.4
	1966	752,300	28	210,644	19,214[d]	11.0	21,017	10.0
	1965	558,700[e]	31	173,197	18,062[d]	9.6	na	na
	1963	596,341	28	166,975	16,995[d]	9.8	na	na
	1960	509,028	28	142,528	na	na	18,536	7.7
AGRICULTURE								
Korea	1970	8,281	28	2,318.7	4,834[a]	0.48	na	na
	1969	7,085	29	2,054.7	4,798[a]	0.43	na	na
	1968	5,685	29	1,648.7	4,863[a]	0.34	4,900	0.34
	1963	3,732	42	1,567.4	5,021[a]	0.31	5,022	0.31
Kenya	1970	1,618[b]	31[b]	501.6	204.5[c]	2.45	na	na
	1969	1,454[b]	32[b]	465.3	195.0[c]	2.39	na	na
	1968	1,344[b]	33[b]	443.5	190.2[c]	2.33	na	na
	1964	924	38	351.1	208.3[c]	1.69	na	na
United States	1971	1,045,753[b]	3[b]	31,373	3,387[d]	9.3	3,619	8.7
	1970	972,581[b]	3[b]	29,177	3,462[d]	8.4	2,840	10.3
	1969	927,876[b]	3[b]	27,836	3,606[d]	7.7	3,781	7.4
	1968	862,700	3	25,881	3,817[d]	6.8	4,005	6.5
	1967	799,300	3	23,979	3,844[d]	6.2	4,045	5.9
	1966	752,300	3	22,569	3,979[d]	5.7	4,439	5.1

(continued)

(Table A3.19a continued)

Industry, country and year		Total GDP (former SNA, million US dollars)	Sector's share of GDP (percent)	Sector's share of GDP (million US dollars)	Employment in sector (thousands)	GDP per employee (thousand US dollars per person)	Economically active population in sector (thousands)	GDP per economically active person (thousand US dollars per person)
(Agriculture, cont.)								
(U. S.)	1965	558,700[e]	4	22,348	4,361[d]	5.1	na	na
	1963	596,341	4	23,854	4,687[d]	5.1	na	na
	1960	509,028	4	20,361	na	na	4,519	4.5
TOTAL ECONOMY								
Korea	1970	8,281	-	-	9,574[a]	0.87	na	na
	1969	7,085	-	-	9,347[a]	0.76	na	na
	1968	5,685	-	-	9,261[a]	0.61	9.757	0.58
	1963	3,732	-	-	7,947[a]	0.47	8,653	0.43
Kenya	1970	1,618[b]	-	-	644.5[c]	2.51	na	na
	1969	1,454[b]	-	-	627.2[c]	2.32	na	na
	1968	1,344[b]	-	-	606.4[c]	2.22	na	na
	1964	924	-	-	589.6[c]	1.57	na	na
United States	1971	1,045,753[b]	-	-	79,120[d]	13.2	86,929	12.0
	1970	972,581[b]	-	-	78,627[d]	12.4	82,049	11.9
	1969	927,876[b]	-	-	77,902[d]	11.9	84,239	11.0
	1968	862,700	-	-	75,920[d]	11.4	82,272	10.5
	1967	799,300	-	-	74,372[d]	10.7	80,793	9.9
	1966	752,300	-	-	72,895[d]	10.3	80,164	9.4
	1965	558,700[e]	-	-	71,088[d]	7.9	na	na
	1963	596,341	-	-	67,762[d]	8.8	na	na
	1960	509,028	-	-	na	na	69,877	7.3

[a]Data includes persons aged 14 and over and is based on labor force sample surveys (civilian labor force employed).

[b]Estimates relate to present SNA.

[c]Date is June of each year. Data is based on statistics of establishments. Employment in rural areas except for large enterprises is excluded beginning in 1968.

[d]Data includes persons aged 16 and over and is based on statistics of establishments in the private sector for manufacturing and construction and labor force sample surveys for the rest.

[e]Private sector only.

Table A3.19b: Gross domestic product per employee and gross domestic product per economically active person in constant national currency units for construction, manufacturing, agriculture, and total economy for Colombia, Iran, Kenya, Korea, and the U.S. (source: ref. 6,22,36,54)

Country and year	Construction			Manufacturing			Agriculture			Total Economy		
	A	B	C	A	B	C	A	B	C	Total GDP (million national currency units)	Total employed or economically active (thousands)	C
Colombia (1958 pesos)												
Economically active												
1970	1,402	316	4.44	7,404	808	9.16	10,691	2,670	4.00	38,500	5,938	6.48
1964	789	221	3.57	5,141	656	7.84	8,541	2,427	3.52	27,200	5,134	5.30
Iran (current rials)												
Economically active												
1966	22,100	336	65.8	158,600	1,268	125.0	121,500	3,169	38.4	540,300	7,584	71.2
Kenya (1964 pounds)												
Employment												
1971	20.8[a]	34.8[a]	0.598	59.5[a]	92.8[b]	0.641	175.2[a]	211.1[b]	0.830	548.2[a]	679.7[b]	0.807
1970	19.0[a]	30.8[b]	0.617	52.5[a]	82.3[b]	0.638	172.3[a]	204.5[b]	0.843	516.2[a]	644.5[b]	0.801
1969	18.6[a]	28.9[b]	0.644	46.6[a]	72.7[b]	0.669	165.4[a]	195.0[b]	0.848	483.3[a]	627.2[b]	0.771
1968	18.4[a]	31.9[b]	0.577	44.6[a]	70.7[b]	0.631	155.3[a]	190.2[b]	0.817	454.8[a]	606.4[b]	0.750
1967	16.3[a]	29.9[b]	0.545	40.9[a]	68.3[b]	0.600	147.3[a]	190.1[b]	0.775	423.7[a]	597.5[b]	0.709
1966	14.9[a]	31.0[b]	0.481	38.2[a]	66.5[b]	0.574	144.8[a]	211.9[b]	0.683	407.9[a]	577.5[b]	0.706
1965	13.0[a]	21.4[b]	0.607	36.2[a]	65.7[b]	0.551	117.7[a]	209.5[b]	0.562	355.7[a]	594.0[b]	0.599
1964	12.6[a]	22.0[b]	0.573	34.2[a]	60.8[b]	0.563	130.2[a]	208.3[b]	0.625	355.0[a]	589.6[b]	0.602
Korea (1965 won)												
Employment												
1970	79,100	279[c]	284	379,300	1,260[c]	301	367,400	4,834[c]	76	1,412,200	9,574[c]	148
1969	74,400	333[c]	224	321,600	1,222[c]	263	370,400	4,798[c]	77	1,283,100	9,347[c]	137
1968	53,900	317[c]	170	263,000	1,181[c]	223	330,800	4,863[c]	68	1,105,100	9,261[c]	119
1967	38,500	264[c]	146	205,300	1,043[c]	197	326,900	4,924[c]	66	973,600	8,914[c]	109
1966	34,800	213[c]	163	165,800	857[c]	193	345,900	5,013[c]	69	900,700	8,659[c]	104
1965	27,600	245[c]	113	142,800	800[c]	179	311,600	5,000[c]	62	798,200	8,522[c]	94
1964	21,800	192[c]	114	116,800	670[c]	174	314,300	5,084[c]	62	743,800	8,210[c]	91
1963	20,700	200[c]	104	111,600	631[c]	177	270,600	5,021[c]	54	686,200	7,947[c]	86
Economically active												
1968	53,900	340	159	263,000	1,231	214	330,800	4,900	65	1,105,100	9,757	113
1967	38,500	264	146	205,300	1,043	197	326,900	4,924	66	973,600	9,504	102
1966	34,800	191	182	165,800	958	173	345,900	4,553	76	900,700	8,654	104
1965	27,600	245	113	142,800	792	180	311,600	5,006	62	798,200	8,199	97
1964	21,800	191	114	116,800	671	174	314,300	5,084	62	743,800	8,894	84
1963	20,700	200	104	111,600	631	177	270,600	5,022	54	686,200	8,653	79
1960	14,400	127	113	80,600	487	166	244,000	4,670	43	581,700	7,543	77

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(Table A3.19b continued)

Country and year	Construction A	Construction B	Construction C	Manufacturing A	Manufacturing B	Manufacturing C	Agriculture A	Agriculture B	Agriculture C	Total Economy: Total GDP (million national currency units)	Total Economy: Total employed or economically active (thousands)	Total Economy: C
United States (1963 dollars)												
Employment												
1971	29,100	3,411[d]	8.53	227,300	18,529[d]	12.3	27,300	3,387[d]	8.1	805,100	79,120[d]	10.18
1970	28,400	3,381[d]	8.40	223,500	19,349[d]	11.6	26,600	3,462[d]	7.7	785,100	78,627[d]	9.99
1969	29,100	3,435[d]	8.47	234,900	20,167[d]	11.6	25,800	3,606[d]	7.2	789,400	77,902[d]	10.13
1968	28,700	3,285[d]	8.74	225,200	19,781[d]	11.4	25,200	3,817[d]	6.6	768,400	75,920[d]	10.12
1967	27,800	3,208[d]	8.67	211,000	19,447[d]	10.9	22,700	3,844[d]	5.9	731,900	74,372[d]	9.84
1966	29,800	3,275[d]	9.10	211,500	19,214[d]	11.0	21,200	3,979[d]	5.3	712,300	72,895[d]	9.77
1965	31,600	3,186[d]	9.92	195,900	18,062[d]	10.8	22,600	4,361[d]	5.2	668,000	71,088[d]	9.40
1964	28,700	3,050[d]	9.41	178,600	17,274[d]	10.3	21,200	4,523[d]	4.7	628,300	69,035[d]	9.10
1963	26,400	2,963[d]	8.91	167,000	16,995[d]	9.8	21,600	4,667[d]	4.6	596,300	67,762[d]	8.80
Economically active												
1971	29,100	5,447	5.34	227,300	20,972	10.8	27,300	3,619	7.5	805,100	86,929	9.26
1970	28,400	4,572	6.21	223,500	20,837	10.7	26,600	2,840	9.4	785,100	82,049	9.57
1969	29,100	5,061	5.75	234,900	21,964	10.7	25,800	3,781	6.8	789,400	84,239	9.37
1968	28,700	4,887	5.87	225,200	21,555	10.4	25,200	4,005	6.3	768,400	82,272	9.34
1967	27,800	4,807	5.78	211,000	21,472	9.8	22,700	4,045	5.6	731,900	80,793	9.06
1966	29,800	4,924	6.05	211,500	21,017	10.1	21,200	4,439	4.8	712,300	80,164	8.89
1964	28,700	4,903	5.85	178,600	19,468	9.2	21,200	5,057	4.2	628,300	76,971	8.16
1960	26,200	4,302	6.09	144,900	18,536	7.8	20,700	4,519	4.6	528,400	69,877	7.56

Note: Heading codes are as follows:

A = Sector's share of GDP (million national currency units)

B = Economically active or employed in sector (thousands)

C = GDP per employee or per economically active (thousand national currency units per person)

[a] Present SNA, all rest former SNA.

[b] Date is June of each year. Data is based on statistics of establishments. Employment in rural areas except for large enterprises is excluded beginning in 1966.

[c] Data includes persons aged 14 years of age and over and is based on labor force sample surveys (civilian labor force employed).

[d] Data includes persons aged 16 and over and is based on statistics of establishments in the private sector for manufacturing and construction and labor force sample surveys for the rest.

Table A3.19c: Value added per person engaged[a] in construction and manufacturing for Ethiopia, Kenya, Colombia, Iran, Korea, and the U.S. (source: calculated from Table A2.14).

Country and year		Construction	Manufacturing
		(thousands of national currency units per person engaged[b])	
Ethiopia[c] (dollar)	1958	na	1.78[d]
	1961	(0.68)[e]	na
	1962	na	1.87[d]
Kenya[f] (shilling)	1963	(14.83)[g]	9.93[h]
	1967	na	13.02[h]
	1968	9.24[g]	13.68[h]
	1969	13.67[g]	14.81[h]
	1970	14.01[g]	14.71[h]
	1971	11.24[g]	na
Colombia[i] (peso)	1968	na	60.58[j]
	1969	56.09	66.61[j]
Iran[k] (rial)	1963	1,252.9	91.1
	1968	na	110.9
Korea[l] (won)	1968	177	405[m]
	1969	234	517[m]
	1970	322	641[m]
United States[n] (dollar)	1958	5.41	8.73(8.83)
	1963	6.51	11.75(11.86)
	1965	7.28	(12.54)
	1967	8.28	(14.18)
	1968	8.82	(15.27)
	1969	7.06	(15.90)
	1970	10.12	(16.31)
	1971	10.80	na

[a]For definitions of value added and persons engaged and for figures for this table see Table A2.14.

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(Table A3.19c continued)

[b]Figures in parentheses are value added per employee.

[c]Construction data are for licensed enterprises engaged in contract construction. Manufacturing data include establishments with five or more employees except those engaged in flour milling for client's account, coffee and grain cleaning, shoe making, and repairing and tailoring.

[d]Excludes value added for sugar cane grown on plantations of sugar refining enterprises.

[e]Value added at purchasers' values.

[f]Construction data are for establishments with five or more employees. Manufacturing data include public and private enterprises with fifty or more persons engaged.

[g]Calculated from value of gross domestic product and persons engaged as of June 30 of year indicated.

[h]Calculated from net of the cost of non-industrial services rendered by others.

[i]Construction data are for all enterprises. Manufacturing data are for establishments with five or more persons engaged or gross value of production of 24,000 pesos or more.

[j]Calculated from persons engaged based on one period of year indicated.

[k]Iran year starts 21 March of year indicated. Construction data are for all enterprises. Manufacturing data include all establishments other than those of the Iranian National Oil Company. These figures for construction are clearly invalid but are presented here along with others from the same source. They cause some doubt as to the validity of the figures for Iran in Table A2.14. For another estimate of productivity in Iran see Table A3.19b or A3.19d.

[l]Construction data are for all registered units, except those of 1968 which are for establishments with five or more persons employed. Manufacturing data are for establishments with five or more persons engaged excluding government establishments other than railroad workshops and tobacco factories.

[m]Calculated from value added in producers' values.

[n]Construction data include all enterprises engaged in contract construction as of January 1. Manufacturing data are for establishments with at least one employee excluding central administrative offices and auxiliaries serving manufacturing establishments (in all years) and excluding those establishments engaged in manufacturing or repair for the retail trade (in 1958 and 1965).

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Table A3.19d: Value added per employee by industry sector for Kenya and Iran (source: ref.18,37)

Industry	Kenya (1963)			Iran (1966)		
	Value added (thousands of pounds)	Employees (number)	Value added per employee (pounds per person)	Value added (millions of rials)	Employees (number in thousands)	Value added per employee (thousands of rials per person)
Construction	7,162	29,660	245	20,700	510	41
Manufacturing	28,580	49,829	573	52,500[a]	1,231[a]	43[a]
Agriculture	na	na	na	105,800	3,745	28
Total	40,789[b]	84,321[b]	484[b]	432,000	7,296	59

[a]Excludes petroleum refining.

[b]Includes mining and quarrying, building and construction, electricity, and manufacturing and repairs.

Table A3.20: The effect of distance and slope on labor productivity in hauling and unloading activities in India and Indonesia[a] (cubic meters per man-hour) (source: ref. 14)

Distance (meters)		Slope					
		0.004	0.032	0.079	0.116	0.15	0.25
India	15	na	na	0.69	0.66	0.64	0.60
	25	0.73	0.59	0.50	0.47	0.46	0.43
	50	0.46	0.37	0.31	0.30	0.29	0.27
	100	0.29	0.24	0.20	0.19	0.18	na
	150	0.22	0.18	0.15	0.15	0.14	na
	200	0.18	0.15	0.13	0.12	0.12	na
Indonesia	15	na	1.04	0.91	0.87	0.83	0.77
	25	na	0.74	0.65	0.61	0.59	0.53
	50	na	0.45	0.39	0.36	0.35	0.31
	100	na	0.26	0.23	0.21	0.20	na

[a]Field studies in India ran from December 1971 to mid-June 1972 and in Indonesia from July to December 1972.

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Table A3.21: The effect of different levels of supervision on resource productivities in India and Indonesia[a] (source: ref.14)

Activity	Method of payment of labor[b]	Output (m^3/hour) Supervision rating[c] 2	3	4	Ratio of higher output to lower output
India					
Excavating and loading cohesive soils into headbaskets	1	na	0.35	0.69	1.97
	3	na	0.51	1.01	1.97
Hauling and unloading homogeneous loose materials by headbaskets	3	na	0.21	0.28	1.33
Indonesia					
Unloading dumper	1	50.6	243.4	na	4.81
Compacting and finishing stone bases, low quality	na	5.7	na	10.9	1.91
Compacting and finishing surface dressing, low quality	1	na	208.8	469.1	2.25

[a]See footnote a, Table A3.20.

[b]Three methods of payment of labor are considered: 1 - daily paid or muster roll (wages and salaries directly related to hours worked), 2 - task work (daily wage for a given task or quantity of work each day), and 3 - piecework (pay at rates for each unit of work completed).

[c]Supervision is rated from 1 to 5 (very poor, poor, fair, good, very good) based on the level of effectiveness of supervision in relation to its effect, in the judgment of the observer, on the input/output relationship. Supervision, levels 3 and 4, covaries with health and nutrition so the effect of better supervision may be overstated.

Table A3.22: Comparison of labor productivities for different methods of payment in India and Indonesia[a] (source: ref. 14)

Activity	Supervision rating[b]	Output (m^3/hour) Payment method[c] Daily wages	Piecework	Ratio of output for piecework to output for daily wages
India				
Excavating and loading cohesive soils into headbaskets	3	0.35	0.51	1.46
	4	0.69	1.01	1.46
Hauling and unloading homogeneous loose materials by headbaskets	2	0.22	0.28	1.27
Indonesia				
Excavating non-cohesive soils	3	1.03	0.55	0.55
Loading homogeneous loose materials into baskets	3	0.74	0.92	1.24
	3	0.64	0.79	1.24
Unloading homogeneous loose materials from headbaskets	3	3.85	6.52	1.69
	3	2.88	4.87	1.69

[a]See footnote a, Table A3.20.

[b]See footnote c, Table A3.21.

[c]See footnote b, Table A3.21.

Table A3.23: Replacement of human labor by machines (source: ref. 38)

Type of machine	Number of laborers replaced
Excavators, 0.15 - 3 cubic meters	20 - 160
Motor-scrapers, from 6 cubic meters	50 - 120
Dozers, from 80 kilograms	70 - 90
Motor-graders, 50 - 120 kilograms	30 - 50
Machines for earth compaction, 4 - 25 tons	20 - 50
Building cranes, 30 - 80 metric tons	30 - 40
Dump-cars, 3 - 5 cubic meters	20 - 30
Motor-cranes, 5 tons	10 - 20
Mixers, 250 - 750 tons	5 - 20
Conveyors, 4 - 15 meters	3 - 5

Table A3.24: Unemployment[a] in numbers and as a percentage of total unemployment, for specific industrial groups, for the U. S. and Korea (source: ref. 22)

Country and industry		1963	1964	1965	1966	1967	1968	1969	1970	1971	1972
United States[b]											
Construction	(thousands)	476	405	378	298	271	259	234	394	447	466
	(percent)	11.4	10.4	10.9	10.0	9.1	9.2	8.3	9.6	9.0	9.6
Manufacturing	(thousands)	1065	944	778	654	780	697	709	1197	1404	1155
	(percent)	25.6	24.4	22.5	22.0	26.2	24.7	25.0	29.3	28.1	23.9
Agriculture, forestry, and fishing	(thousands)	171	174	122	99	102	92	79	100	108	108
	(percent)	4.1	4.5	3.5	3.3	3.4	3.3	2.8	2.4	2.2	2.2
Total unemployment	(thousands)	4166	3876	3456	2976	2975	2817	2831	4088	4993	4840
Korea[c]											
Construction	(thousands)	14	16	20	14	21	23	23	13	17	41
	(percent)	2.0	2.3	3.0	2.1	3.6	4.6	4.9	2.9	3.7	8.6
Manufacturing	(thousands)	65	63	56	41	56	50	55	49	51[d]	78[d]
	(percent)	9 2	9.2	8.3	6.2	9.5	10.1	11.7	11.0	11.2[d]	16.4[d]
Agriculture, forestry, and fishing	(thousands)	69	69	55	63	40	37	29	29	30	22
	(percent)	9.7	10.0	8.1	9.5	6.8	7.5	6.2	6.5	6.6	4.6
Total unemployment	(thousands)	705	683	677	666	590	496	471	446	457	474

[a]Unemployment includes persons seeking work whether or not they were previously employed and persons available for work who were previously employed, including persons temporarily laid off. Figures are based on labor force sample surveys.

[b]Persons aged 16 or over, 1963-1966 aged 14 or more.

[c]New industrial classification came into effect in 1971.

[d]Excludes all repair services.

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Table A3.25: Full- and part-time employment in the construction industry in Korea, 1966-1970 (source: ref. 12)

Type of employment	1966	1967	1968	1969	1970
Full-time employees in construction	21,753	26,203	48,631	31,513	55,935
Day laborers in construction (thousands of man-days)	38,427	48,103	68,520	117,925	93,922

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Table A3.26: Instability in the manufacturing and construction industries of various developed and developing countries, 1956-1964 (average annual deviation from trend[a], in percentage points) (source: ref. 23)

Country	Manufacturing	Construction
Eastern Europe		
Bulgaria	4.4	8.2
Czechoslovakia	1.3	3.5
Hungary	1.8	2.9
Poland	1.5	2.7
Romania	2.8	8.4
Yugoslavia	1.4	3.5
Developed market economies		
Canada	3.4	2.4
United States	2.2	2.5
Japan	1.3	2.3
Austria	1.2	2.7
France	1.1	2.4
Norway	1.4	0.8
Switzerland	2.8	7.1
New Zealand	0.8	1.3

Country	Manufacturing	Construction
Developing countries		
Cameroon	1.7	26.8
Gabon	13.6	13.4
Kenya	7.7	3.5
Malawi	5.5	5.8
Sierra Leone	8.7	8.0
Uganda	2.2	2.5
Zambia	2.3	9.8
Trinidad and Tobago	3.7	8.3
Philippines	1.1	6.8
Singapore	6.1	22.4
Malta	2.7	15.7
Turkey	2.6	4.7
Fiji	5.6	40.0

[a] The trend has been measured as the average annual percentage rate of change (a simple annual average rate of change was adopted rather than a compound one, yielding a linear trend) recorded between the average level of employment in the three years at the beginning of this period, 1956, 1957, and 1958, and the average level of employment in the three years at the end of this period, 1962, 1963, and 1964. The deviations, plus or minus, of the actual employment level recorded in each of the nine years, 1956 to 1964, from this trend line, measured in percentage points, have been summed and averaged to give a rough measure of the extent of employment fluctuations about the trend.

Table A3.27a: Average number of hours per week per wage earner in the construction industry, the manufacturing industry, and the total non-agricultural sector in the United States and Korea (source: ref. 22)

Country and industry	1963	1964	1965	1966	1967	1968	1969	1970	1971	1972	1973
Korea[a]											
Construction	46.5	48.9	49.6	51.8	53.5	54.6	53.3	47.3[b]	51.2	48.8	na
Manufacturing	50.3	56.0	57.0	57.4	53.8	57.6	56.3	52.3[b]	51.9	51.6	52.3[c]
Non-agricultural sector	55.4	55.7	57.0	57.2	56.8	58.5	57.2	51.7[b]	51.9	50.8	51.5[c]
United States[d]											
Construction	37.3	37.2	37.4	37.6	37.7	37.4	37.9	37.4	37.3	37.0	na
Manufacturing	40.5	40.7	41.2	41.4	40.6	40.7	40.6	39.8	39.9	40.6	40.9
Non-agricultural sector	38.8	38.7	38.8	38.6	38.0	37.8	37.7	37.1	37.0	37.2	37.4

[a] Based on hours actually worked per week which include all hours worked during normal periods of work, overtime, time spent at place of work waiting or standing by, short rest period (coffee breaks). Includes salaried employees.

[b] New series replacing former series.

[c] Second quarter only.

[d] Based on hours paid for which include, in addition to hours actually worked, paid vacation, paid public holiday, paid sick leave, etc.

Table A3.27b: Hours worked per week by the occupied population of Bogotá, Colombia, by industry sector, September 1969 (percentages of total in each sector) (source: ref. 21)

Industry sector	Hours worked per week				
	0-31	32-47	48-63	64 or more	No information
Construction	9	46	40	5	0
Manufacturing	4	34	50	10	2
Total[a]	5	31	45	18	1

[a]In addition to two sectors in table, this includes commerce, transport, services, domestic service, and government services.

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Table A3.28: Compensation[a] per employee, by industry sector, for Korea and the United States (source: calculated from Table A2.3 and ref. 56)

Country and industry	1968 Compensation of employees (billions)	1968 Compensation per employee (thousands)	1969 Compensation of employees (billions)	1969 Compensation per employee (thousands)	1970 Compensation of employees (billions)	1970 Compensation per employee (thousands)	1971 Compensation of employees (billions)	1971 Compensation per employee (thousands)
	(national currency units)							
Korea (won)								
Construction	47.8	150.79	71.6	215.02	88.8	318.28	103.6	311.11
Manufacturing	120.2	101.78	171.1	140.02	217.8	172.86	268.5	208.62
Agriculture, hunting, forestry, and fishing	56.9	11.70	68.4	14.26	77.6	16.05	93.4	19.83
Total industry[b]	401.2	43.32	545.0	58.31	689.7	72.04	841.4	86.67
United States (dollar)								
Construction	29.6	9.01	33.6	9.78	35.7	10.56	39.0	11.43
Manufacturing	166.4	8.41	180.2	8.94	182.4	9.43	187.0	10.09
Agriculture, hunting, forestry, and fishing	4.0	1.05	4.3	1.19	4.8	1.39	5.1	1.51
Total industry[b,c]	394.1	5.19	434.0	5.57	458.2	5.83	485.4	6.13

[a] Compensation of employees consists of (a) all wages and salaries, in cash and in kind, paid to employees; (b) the contributions made by employers to social security schemes in respect of their employees; and (c) the contributions, paid or imputed, made by employers to private pension arrangements, family allowances, health insurance, lay-off and severance pay, and other casualty insurance and similar schemes in respect of their employees.

[b] Other industries include mining and quarrying; electricity, gas, and water; wholesale and retail trade; restaurants and hotels; transport, storage, and communication; financing; insurance; real estate; and business services.

[c] Also includes community, social, and personal services.

Table A3.29a: Ratio of skilled to unskilled wages for workers in various developing and developed countries (source: ref. 36)

Country and year	Ratio
Africa (1960-1962)	
Algeria	2.01
Congo (Brazzaville)	2.87
Congo (Kinshasa)	2.68
Ghana	2.40
Ivory Coast	1.97
Nigeria	1.57
Senegal	2.53
Tanzania	2.11
Tunisia	1.79
Latin America (1958-1962)	
Argentina	1.32
Brazil	1.84
Chile	2.09
Colombia	1.81
Mexico	2.12
Peru	1.71
Venezuela	1.86
Asia	
Hong Kong (1962)	1.75
India (1959)	1.68
Pakistan (1962)	1.59
Philippines (1961)	1.40
United Kingdom (1962)	1.18
France (1962)	1.39

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Table A3.29b: Ratio of wages of skilled to unskilled workers in construction in Ethiopia, Kenya, Korea, Iran, and the United States (source: ref. 10, 40, 44)

Country and year	Wages of skilled worker (dollars)	Wages of unskilled worker (dollars)	Ratio of skilled to unskilled
Ethiopia[a] (per day)	2.40	0.40	6.00
Kenya[a] (per day)	1.00	0.67	1.49
Korea[b] (per day)	5.00[c]	2.00	2.50
Iran[b] (per day)	3.10[c]	0.92	3.37
United States[d] (per hour)			
1961	4.10	2.75	1.49
1963	4.40	3.15	1.40
1965	4.75	3.45	1.38
1967	5.15	3.85	1.34
1969	6.05	4.55	1.33
1971	7.95	6.05	1.31

[a]Data are for the early 1960's (ref. 40).

[b]Around 1960 (ref. 44).

[c]Figure is average of brick or mason layer's daily wage and carpenter's daily wage.

[d]Figures are averages of the thirty largest cities in the U.S. as reported by the U.S. Department of Labor and are substantially the same as listed by the <u>Engineering News-Record</u>. The rates have been rounded to the nearest five cents and include fringe benefits but do not include insurance or taxes (ref. 10).

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Table A3.30: Indexes of wages in the construction industry for Korea and Iran (source: ref. 12)

Country and type of labor	1963	1964	1965	1966	1967	1968	1969	1970
Korea (1965 = 100)								
Ordinary labor	75	90	100	115	150	190	215	270
Semi-skilled labor	80	92	100	112	160	188	212	284
Iran[a] (1959/60 = 100)								
Bricklayers	na	101.0	105.8	112.5	112.4	122.3	136.0	140.0
Unskilled laborers	na	107.7	108.8	92.2	119.4	139.4	166.7	174.4
All workers	na	103.2	106.8	106.1	114.7	128.0	146.2	151.4

[a]Figures are for split years: 1964 above is 1964/65, etc.

Table A3.31: Industrial disputes[a] by industry sector in Kenya, Korea, and the United States (source: ref. 22)

Country, year, and measure of disputes		Construction	Manufacturing	Agriculture, forestry, and fishing	Total
Kenya					
1963	Number of disputes	6	66	81	230
	Workers involved	664	8,337	23,820	54,428
	Working days lost	1,555	37,324	62,602	235,349
1965	Number of disputes	13	40	59	200
	Workers involved	12,464	22,071	11,814	105,602
	Working days lost	69,005	31,912	24,164	345,855
1967	Number of disputes	11	20	41	138
	Workers involved	847	3,802	9,374	29,985
	Working days lost	1,931	6,298	27,631	109,128
1969	Number of disputes	12	28	38	110
	Workers involved	2,003	13,491	9,479	38,793
	Working days lost	19,834	6,598	15,080	87,816
1971	Number of disputes	5	16	22	74
	Workers involved	344	1,557	4,242	14,398
	Working days lost	825	4,489	6,359	32,681
Korea[b]					
1963	Number of disputes	2	30	1	70
	Workers involved	1,552	6,712	95	19,999

(continued)

(Table A3.31 continued)

Country, year, and measure of disputes		Construction	Manufacturing	Agriculture, forestry, and fishing	Total
(Korea, cont.)					
1964	Number of disputes	1	3	-	7
	Workers involved	50	923	-	1,204
1965	Number of disputes	-	6	-	12
	Workers involved	-	1,168	-	3,852
1967	Number of disputes	-	8	-	18
	Workers involved	-	1,022	-	2,787
	Working days lost	-	4,297	-	10,004
1969	Number of disputes	-	6	-	7
	Workers involved	-	29,772	-	30,499
	Working days lost	-	161,547	-	163,353
1971	Number of disputes	-	4	-	10
	Workers involved	-	177	-	832
	Working days lost	-	6,707	-	11,323
United States[c]					
1963	Number of disputes	840	1,684	25	3,362
	Workers involved	208,000	555,000	16,000	941,000
	Working days lost	1,930,000	10,400,000	84,600	16,100,000
1965	Number of disputes	943	2,080	21	3,963
	Workers involved	301,000	913,000	4,300	1,550,000
	Working days lost	4,630,000	14,300,000	60,300	23,300,000

(continued)

(Table A3.31 continued)

Country, year, and measure of disputes		Construction	Manufacturing	Agriculture, forestry, and fishing	Total
(United States, cont.)					
1967	Number of disputes	867	2,328	18	4,595
	Workers involved	305,000	1,350,000	7,730	2,870,000
	Working days lost	5,160,000	27,800,000	70,400	42,100,000
1969	Number of disputes	973	2,822	16	5,700
	Workers involved	433,000	1,310,000	14,600	2,480,000
	Working days lost	10,400,000	24,100,000	228,000	42,900,000
1971	Number of disputes	751	2,391	7	5,138
	Workers involved	451,300	862,700	1,500	3,279,600
	Working days lost	6,849,600	18,484,800	4,200	47,589,100

[a] Industrial disputes which resulted in a stoppage of work. No differentiation between strikes and lockouts has been possible, since in most cases the distinction is not observed in the compilations. Disputes of small importance and political strikes are frequently not included in the statistics.

[b] Excludes workers indirectly affected.

[c] Excludes disputes involving less than six workers and those lasting less than a full day or shift.

Table A3.32a: Distribution of cost of materials and equipment per thousand dollars of contract cost for new federally aided highway construction in the U.S. (dollars per $1000 of contract cost)(source: ref. 1,58)

Material	1958	1961	1964	1967[a]	1970[a]	1971[a,b]
Total	626	643	624	478	450	451
Steel	122	147	125	107	95	92
Structural steel	56	68	49	na	na	na
Reinforcing steel	39	47	45	na	na	na
Miscellaneous steel	18	24	23	na	na	na
Culvert pipe	9	8	8	na	na	na
Petroleum products	107	85	82	97	92	97
Premixed bituminous paving material	45	33	29	na	na	na
Fuels and lubricating oils	35	33	39	na	na	na
Bituminous material	27	19	14	na	na	na
Cement and concrete	105	106	106	109	100	91
Cement	49	46	44	na	na	na
Ready-mix concrete	41	48	46	na	na	na
Culvert pipe	15	12	15	na	na	na
Aggregates purchased	71	68	93	95	83	83
Lumber and timber piling	11	10	10	7	7	6
Explosives	5	6	8	14	9	5
Guardrail and bridge rail	-[c]	-[c]	-[c]	14	18	17
Construction equipment	120	117	111	na	na	na
Other	85[c]	104[c]	89[c]	34	46	60

Note: Detail may not add to totals due to rounding.

[a]Figures do not include construction equipment.

[b]Preliminary.

[c]Guardrail and bridge rail included with other.

Table A3.32b: Distribution of cost of materials and equipment for construction of new private single-family houses in the U.S., 1962 and 1969 (source: ref. 59)

Material	Cost of material (dollars) per 100 square feet		Cost of material (dollars) per $1000 of construction cost	
	1962	1969	1962	1969
All materials	567.40	707.00	482.40	442.90
Lumber and wood products	227.20	286.30	193.20	179.60
Rough and dressed lumber	129.50[a]	162.00	110.10[a]	101.60
Millwork	60.30	60.70	51.30	38.10
All other lumber products[b]	37.40	63.60	31.80	40.00
Stone, clay, and glass products	137.10	153.40	116.60	95.30
Cement, concrete, and gypsum	90.20	87.00	76.70	54.50
Structural clay products	23.20	35.00	19.70	22.00
Other stone, clay and glass products[c]	23.80	31.40	20.20	18.90
Metal products (except heating and plumbing)	64.70	66.60	55.00	41.80
Fabricated metal products	42.80	49.80	36.40	31.20
Other metal products	21.90	16.80	18.60	10.60
Plumbing products	31.50	48.70	26.80	30.60
Heating, ventilating, and air conditioning equipment	21.80	29.20	18.50	18.40
Electrical equipment, fixtures, and wires (except heating)	20.70	27.80	17.60	17.40
Built-in major appliances (refrigerators, dishwashers, dryers, ranges, etc.)	16.10	17.80	13.70	11.20
Petroleum products	13.10	12.70	11.10	8.00
Paints and other chemicals	12.10	12.80	10.30	8.00
Construction equipment (rental cost or equivalent)	11.50	13.70	9.80	8.60
All other	11.60	38.10	9.80	23.90

Note: Detail may not add to totals due to rounding.

[a]Includes data for prefabricated or packaged houses not broken down into separate wood components.

[b]Includes wood kitchen and bathroom cabinets and vanities.

[c]Includes sand, gravel, and dirt fill.

Table A3.33: Prices of construction materials in Korea and Iran around 1960 (U.S. dollars) (source: ref. 44)

Material	Korea	Iran
Brick or block[a] (per thousand)	34.6	6.2
Sand (per cubic meter)	3.6	1.5
Cement (per ton)	64.0	26.4
Lime (per ton)	40.0	5.3
Stone chips (per cubic meter)	5.0	-
Hardwood (per cubic meter)	120.0(mahogany)	-
Softwood (per cubic meter)	54.0	46.2
Mild steel (per ton)	260.0	204.5

[a]The prices of bricks or blocks were converted to the equivalent of one thousand pieces 9" x 4½" x3" in volume.

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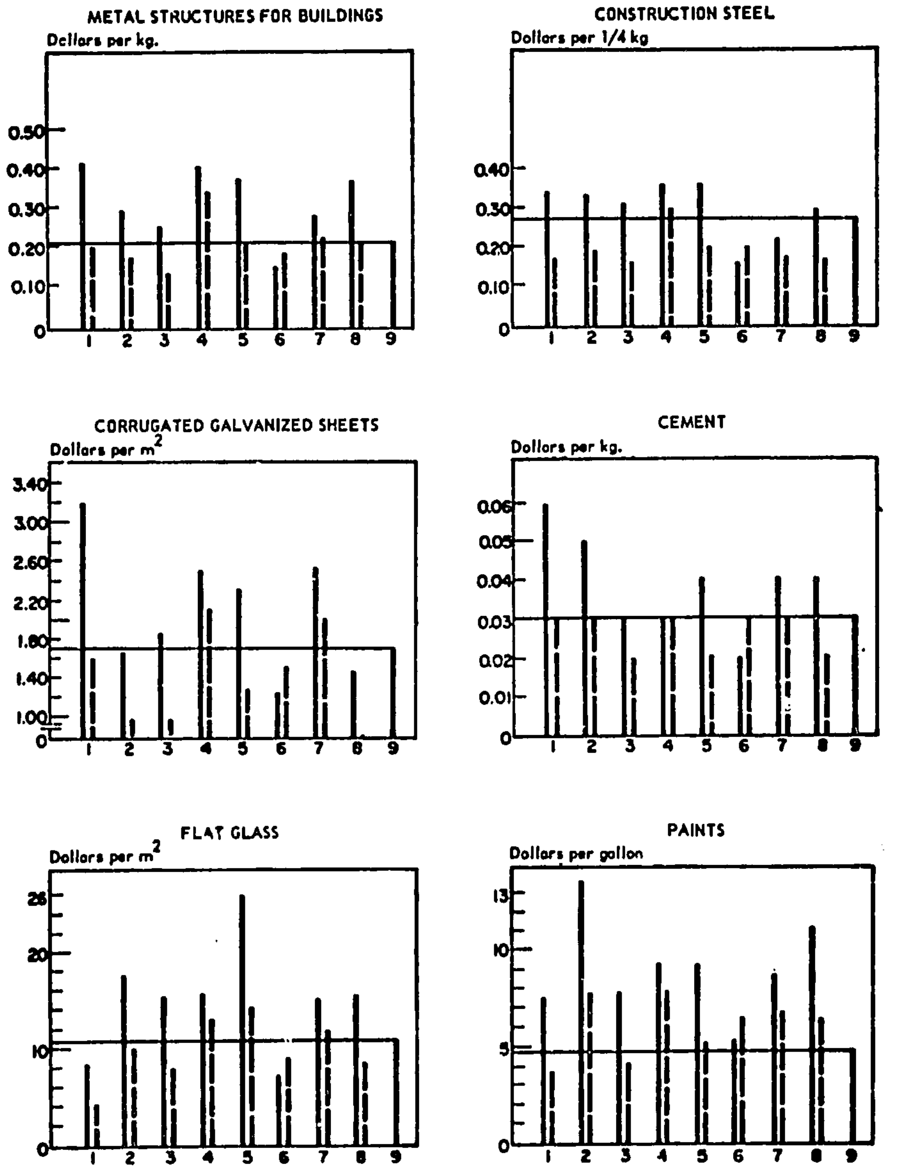
Figure A3.1: Comparison between unit prices of construction materials in Latin America and the United States, 1962 (source: ref. 45)



Note: Unit price code is as follows:
———— Estimated parity exchange rate
--------- Free exchange rate

Country code is as follows:

1-Argentina	5-Peru	9-United States
2-Brazil	6-Venezuela	
3-Colombia	7-Guatemala	
4-Chile	8-Mexico	

3/0

Table A3.34: Indexes of building material costs for Korea, Iran, and Ethiopia, 1962-1970 (source: ref. 12)

Country and index	1962	1963	1964	1965	1966	1967	1968	1969	1970
Korea (1965 = 100)									
Construction materials and equipment	na	63.2	84.5	100.0	112.8	114.9	125.4	130.7	159.1
Iran[a] (1959/60 = 100)									
All building materials	na	na	91.4	91.8	90.2	94.5	95.0	108.9	107.3
Metals	na	na	98.5	97.3	96.7	104.0	101.2	145.0	141.2
Non-metals	na	na	88.7	89.7	90.6	91.0	92.7	95.6	94.9
Ethiopia (1964 = 100)									
Building materials	106.3	106.1	100.0	102.1	101.3	107.6	117.6	114.2	117.3

[a]Figures are for split years: 1964 above is 1964/65, etc.

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Table A3.35: Consumption of basic building materials, in the world and in Africa and its subregions (source: ref. 37)

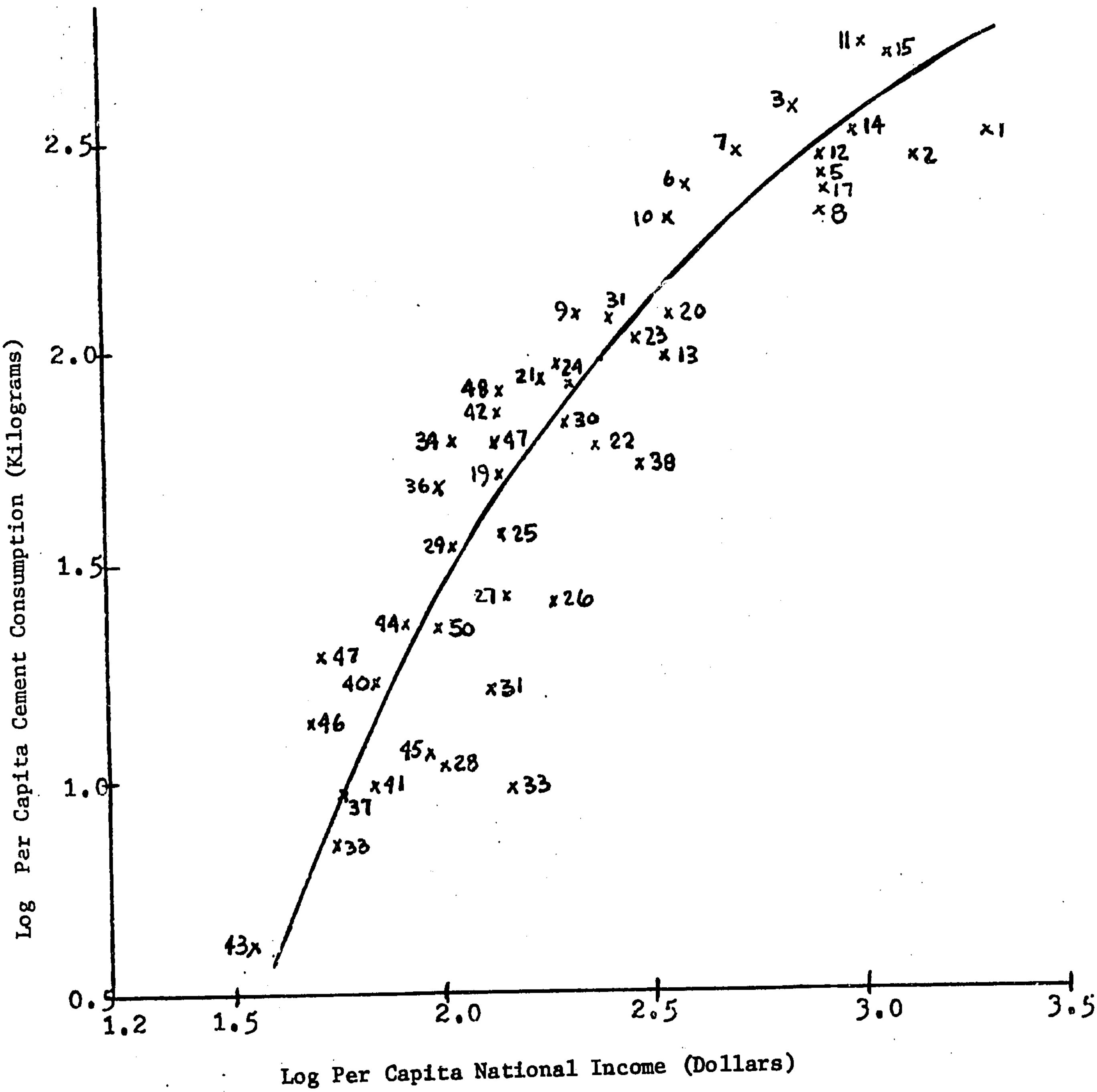
	North Africa	West Africa	Central Africa	East Africa	Southern Africa	Africa	World
Average annual per capita consumption[a]							
Cement (kg.)	68	23	19	17	146	39	110
Crude steel (kg.)	16	6	5	6	135	17	116
Sawnwood (m^3/1000 inhabitants)	18	7	10	6	42	12	110
Plywood (m^3/1000 inhabitants)	1.2	0.3	0.4	0.3	0.6	0.6	5.6
Board products (kg.)	0.40	0.13	0.02	0.10	2.37	0.30	2.3
Average compounded annual growth rates of per capita consumption[b] (percentage)							
Cement	4.1(4.1)	6.7(7.5)	-(1.1)	0.6(7.5)	4.2(3.6)	2.8(3.3)	5.6(6.1)
Crude steel	3.9(6.9)	7.2(8.0)	- (-)	- (1.5)	2.2(4.1)	2.7(5.7)	3.2(3.9)
Sawnwood	1.2(5.6)	13.1(14.9)	-(2.9)	- (5.9)	2.5(11.0)	2.9(5.4)	2.7(3.8)
Plywood	10.0(11.2)	11.6(18.9)	-(7.2)	7.2(25.9)	11.6(14.9)	7.2(17.7)	7.2(7.2)
Board products	14.8(20.1)	12.5(15.9)	-(28.3)	- (7.4)	12.2(13.4)	0.5(16.5)	9.6(9.6)
Average compounded annual growth rates of consumption[c] (percentage)							
Cement	7	8	-	3	5	6	na
Crude steel	6	9	-	3	5	5	na
Sawnwood	4	14	1	3	5	5	na
Plywood	12	16	-	12	15	8	na
Board products	22	13	-	-	-	3	na

[a]Figures are for the early 1960's.

[b]Figures in brackets are the best compounded rates of growth sustained over a period of not less than five years during the period, 1953-1963; other figures are average compounded rates for the whole period, 1953-1963.

[c]Figures are for the period, 1953-1963.

Figure A3.2: Per capita consumption of cement versus per capita national income[a] (source: ref. 29)



Note: Country code is as follows: 1-USA, 2-Canada, 3-West Germany, 4-Netherlands, 5-France, 6-Italy, 7-Austria, 8-Denmark, 9-Greece, 10-Ireland, 11-Iceland, 12-Norway, 13-Portugal, 14-Sweden, 15-Switzerland, 16-Turkey, 17-United Kingdom, 18-Argentina, 19-Brazil, 20-Chile, 21-Colombia, 22-Costa Rica, 23-Cuba, 24-Dominican Republic, 25-Ecuador, 26-El Salvador, 27-Guatemala, 28-Haiti, 29-Honduras, 30-Mexico, 31-Nicaragua, 32-Panama, 33-Paraguay, 34-Peru, 35-Venezuela, 36-Taiwan,

(Figure A3.2 continued)

37-India, 38-Malaysia, 39-Pakistan, 40-Philippines, 41-Thailand, 42-Japan, 43-Indonesia, 44-Ceylon, 45-East African Federation, 46-Taganyika, 47-Tunisa, 48-Morocco, 49-West African Federation, 50-Cameroon.

[a]No date given, original source is 1963.

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Table A3.36: Magnitudes of apparent consumption of building materials and structure of supply, for Africa and its subregions (source: ref. 37)

Material and year		Africa		North Africa		West Africa		East Africa		Central Africa		Southern Africa	
		A	B	A	B	A	B	A	B	A	B	A	B
Sawnwood (millions of cubic meters)	1953	2.2	49	0.9	96	0.2	0	0.3	0	0.4	15	0.4	92
	1963	3.5	32	1.3	94	0.6	0	0.3	0	0.5	0	0.8	41
Plywood (millions of cubic meters)	1953	0.071	5	0.03	82	0.006	0	0.026	0	0.006	87	0.003	83
	1963	0.161	0	0.093	44	0.027	0	0.017	0	0.012	0	0.012	5
Particle board (thousands of tons)	1953	47	23	4	100	3	100	1	100	9	100	30	0
	1963	61	0	30	71	10	100	1	100	8	100	12	0
Cement (millions of tons)	1953	7.4	28	2.8	12	0.9	93	0.7	62	1.0	50	2.0	0
	1963	12.1	20	5.3	12	2.0	65	0.6	23	1.3	0	2.9	0
Crude steel (millions of tons)	1953	3.1	52	0.6	85	0.2	100	0.2	100	0.4	49	1.7	24
	1963	5.0	38	1.1	75	0.5	100	0.2	100	0.5	87	2.7	0

Note: A = Apparent consumption.
B = Percent imported.

Table A3.37: Apparent consumption, production, and imports of steel in developing countries, 1950, 1960, and 1965 (crude-steel equivalent) (source: ref. 26)

	1950	1960	1965
Apparent consumption (thousand tons)	9,715	20,770	31,708
Local production (thousand tons)	2,836	9,282	16,977
Imports (thousand tons)	6,879	11,488	14,729
Local production as percentage of apparent consumption	29.5	44.5	54

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Table A3.38a: Analysis of local consumption of steel in 1965 in developing countries with and without a local steel industry[a] (source: ref. 26)

	Africa	Asia	Latin America	Total
Steel-producing countries:				
Number of countries	8	12	8	28
Consumption (thousand tons[b])	2,034	13,006	11,320	26,360
Production (thousand tons[b])	299	8,473	8,205	16,977
Production as a percentage of consumption	15	65	71	64
Other developing countries:				
Number of countries	30	14	13	57
Consumption (thousand tons[b])	1,257	3,267	824	5,348

[a]This is an analysis of the data in Table A3.37, according to countries with and without a local steel industry.

[b]Crude steel or crude-steel equivalent.

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Table A3.38b: Total and per capita consumption of steel in steel-producing countries of Latin America, 1961 (source: ref. 29)

Country	Total consumption (tons)	Per capita consumption (pounds)
Brazil	2,701,000	82
Mexico	1,840,000	111
Argentina[a]	2,379,000	248
Chile	506,000	143
Colombia	405,000	62

[a]The Argentine automobile industry accounts for a large part of this country's consumption.

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Table A3.38c: Per capita steel consumption in developing countries which do not produce steel, 1965 (pounds) (source: ref. 29)

Country	Per capita consumption
Ceylon	15
China (mainland)	30
Congo	7
East Africa	13
Ghana	29
Indonesia	7
Malawi	2
Morocco	28
Nigeria	13
Syria	34

Table A3.39a: Production, trade, and consumption of sawnwood for Africa's subregions, 1959-1961[a] (thousands of cubic meters) (source: ref. 40)

Subregion	Production			Imports			Exports			Consumption[b]	
	1959	1960	1961[c]	1959	1960	1961[c]	1959	1960	1961[c]	Total	Per million inhabitants
North Africa	107	110	(85)	803	902	1090	2	2	2	1205	18.3
West Africa	548	829	963	34	31	27	301	329	347	704	8.3
Central Africa	433	355	376	5	6	7	113	94	70	322	13.7
East Africa	317	334	297	161	173	126	52	58	61	580	9.4
Madagascar	41	47	45	4	2	2	-	-	-	50	9.3
Total	1447	1675	1766	1007	1114	1251	468	483	481	2861	11.8

[a]Data on production, imports, and exports are from specialized publications of the FAO, completed, where possible, with information from the secretariat. Consumption figures are from a current FAO study on timber trends in Africa.

[b]Figures are for around 1960.

[c]The coverage of 1961 figures is often incomplete.

Table A3.39b: Production, trade, and consumption of plywood and veneers for Africa's subregions, 1959-1961[a] (thousands of cubic meters)(source: ref. 40)

Subregion	Production	Imports	Exports	Consumption[b]	
	Average 1959-61	Average 1959-61	Average 1959-61	Total	Per million inhabitants[c]
North Africa	8	41	-	(90)	1.37
West Africa	30	14	22	21	0.25
Central Africa	65	1	57	8	0.32
East Africa	3	8	1	16	0.26
Madagascar	-	1	-	1	0.20
Total	107	65	80	136	0.56

[a]See footnote a, Table A3.39a.

[b]Figures are for around 1960.

[c]Comparable figures on consumption in cubic meters per thousand inhabitants are 6.6 for Europe, 5.9 for the USSR, and nearly 30 for North America.

Table A3.40: Removals of coniferous and broadleaved wood and production of sawnwood for Africa's subregions, 1960 (millions of cubic meters) (source: ref. 40)

Subregions	Removals industrial wood	Production of sawnwood	Sawnwood as a percentage of total removals of industrial wood
North Africa	0.73	0.11	15
West Africa	5.73	0.84	15
Central Africa	3.96	0.35	9
East Africa	2.68	0.32	12
Madagascar	0.45	0.05	11
Total	13.55	1.67	12.3

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Table A3.41: Transportation data for Ethiopia, Kenya, Korea, Iran, Colombia, and the U.S., 1969 (source: ref. 15)

	Ethiopia	Kenya	Korea	Iran	Colombia	U.S.
Mid-1969 population (millions)	24.8	10.9	31.1	28.5	20.6	203.2
Area (km^2)	1,031,647	582,601	98,423	1,647,872	1,179,227	9,374,826
Road network length (km)	7,304	41,660	37,170	35,800	44,200	5,928,794
Paved road length (km)	1,957	2,489	3,120	10,200	5,300	2,533,374
Total number of vehicles	51,200	125,300	120,324	273,000	264,300	99,958,000
Number light vehicles	39,000	115,000	56,254	200,000	141,100	82,821,000
Number heavy vehicles	12,200	10,300	64,070	73,000	123,200	17,137,000
Road density (km/km^2)	0.007	0.072	0.378	0.022	0.037	0.632
Paved road density (km/km^2)	0.002	0.005	0.032	0.006	0.004	0.270
Vehicles per thousand population	2.1	11.5	3.9	9.6	12.8	491.9
Light vehicles	1.6	10.6	1.8	7.0	6.8	407.6
Heavy vehicles	0.5	0.9	2.1	2.6	6.0	84.3

Table A3.42: Types of construction recommended by various governments for low-cost housing programs[a] (source: ref. 29)

Region	Type of housing proposed	Suggested building materials	Total floor area per unit (ft^2)	Total space per person(ft^2)
Pakistan	1-story with central courtyard	permanent	275	125
India	1-story semidetached	brick	250 to 480	135 to 190
India	village house	mud, thatch	500	250
Hong Kong	5-6 story tenement	concrete	120	36
Hong Kong	11-story flats	concrete	413	58
Singapore	semi-urban small dwelling	timber, thatch	530	400
Kenya	2-story	permanent	960	132
Tanganyika	1-story	semipermanent	1000	200 to 400
Uganda	1-story detached	semipermanent	1000	280 to 560
Zanzibar	1-story house	semipermanent	660	190 to 380
South Africa	detached house	permanent	650	530
West Indies	1-story detached house	timber	500	150 to 300
Latin America	1-story rural detached house	--	684	388 to 465

[a]Original source is dated 1959.

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Table A3.43: The balance of labor and machinery in road maintenance[a] (source: ref. 33)

Maintenance operation	Labor-intensive				Machinery-intensive				Balanced		
	Labor	Equipment	Materials	Total	Labor	Equipment	Materials	Total	Labor	Equipment	Total
Cutting, clearing brush and grass (dollars/hectare)	11.37	1.43	-	12.80	2.16	3.65	-	5.81	-	-	-
Surface upkeep of dirt road[b] (dollars/km)	59.70	16.55	-	76.25[c]	4.87	16.19	-	21.06	26.18	15.43	41.61
Sealing paved highway[d] (dollars/km)	308.00	181.00	672.80	1161.80	23.83	71.17	672.80	767.80	-	-	-
Reshaping ditches and shoulders (dollars/km)	87.30	43.13	-	130.43[c]	18.14	23.71	-	41.85	36.45	18.87	55.32

[a]Original source is dated 1972.

[b]5 meter wide road.

[c]Adjusted to reflect an application frequency 2.5 times that of a mechanized operation.

[d]6.5 meter wide road.

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Table A4.1: A very rough estimate of the size of the construction market in developing market economies served by multi-national firms around 1967.

1. GDP in purchasers' values for 1967 for developing market economies: 295.1 billion dollars (Table 2.2).

2. Value added in construction as a share of GDP for developing market economies averaged over 1966-1968: 4 percent (Table 2.2).

3. Value added in construction in developing market economies in 1967: 11.8 billion dollars.

4. Ratio of value added in construction to GDCF in construction for countries with a per capita GNP of less than 700 dollars in 1965: about 0.50 (Table 2.1).

5. Approximate GDCF in construction in developing market economies in 1967: about 23.6 billion dollars.

6. Share of construction in the developing countries around 1965 which according to a UNIDO report (11) falls into the international-modern category and was handled largely by expatriate firms (most of the rest of the construction was handled by indigenous firms): 20% of all construction, 25% of monetary sector construction (the latter will be used since nonmonetary sector construction is often not reported).

7. Estimate of GDCF in construction in developing market economies in 1967 performed by multi-national firms: about 5.9 billion dollars.

Alternative measure:

1.- 3. Same as above.

4. Value added as a share of construction output in a typical developing country in the early sixties: 45% (Table 2.6).

5. Approximate construction output in developing market economies in 1967: about 26.2 billion dollars.

6. Same as above.

7. Estimate of construction output in developing market economies in 1967, performed bv multi-national firms: about 6.5 billion dollars.

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APPENDIX B

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