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STUDY OF THE STRUCTURE AND CAPACITY OF CONSTRUCTION INDUSTRY IN PAKISTAN

by

TAYYAB A. ANSARI

Thesis submitted to the faculty of
the New Jersey Institute of Technology in partial
fulfillment of the requirement for the degree of
Master of Science in Civil Engineering
1988

APPROVAL SHEET

Title of thesis : STUDY OF THE STRUCTURE AND CAPACITY OF CONSTRUCTION INDUSTRY IN PAKISTAN.

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Year : 1988

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ABSTRACT

Title of Thesis : Study of the structure and capacity of construction industry in Pakistan.

Name of student : Tayyab A. Ansari
Master of science in Civil Engineering.
1988

Thesis directed by : Prof. Edward G. Dauenheimer
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Newark, New Jersey.

The study will review the domestic construction industry and the construction material manufacturing industry in order to ascertain the following :

1. Participation in construction by the public, private large-scale, medium contractors, petty contractors and force account operation.

2. Constraints on the development of the construction industry and obstacles to increased efficiency.

3. Ways and means to remove these constraints and obstacles.

4. The structure and recent performance of the building materials industry in the production of cement, steel, aggregate, bricks, pipes, timber, bitumen, tools, equipment etc.

5. The demand projections for key materials in the public and private sectors, assess the industry's investment program and consistency of the program and construction demand in the coming years.

Based on this review, projections of the construction industry requirements were made.

DEDICATED TO

Tahir Ahmed Ansari

ACKNOWLEDGEMENTS

This work has benefited from the direction, support and technical & otherwise help of several persons along the way. All of these have had their contributions towards the successful completion of the thesis besides my own efforts.

In the first place, I am grateful to my thesis advisor, Professor Edward Dauenheimer, whose continued support and guidance has been a source of motivation for me during all this period.

My friend, Syed Javed Hasan was kind enough to search for and send certain relevant source material to me from Pakistan on a regular basis and thus deserves many thanks.

Among other helping hands, have been Farrukh Warsi and Waqar Naz, who wrote computer programs to make the tedious calculations of Forecasting Equations possible.

A wealth of good tips and ideas flowed into the preparation and compilation of the thesis report from several other colleagues and well wishers. Thanks to all of you who encouraged and appreciated my efforts and showed great interest in successful accomplishment of this task. Thankyou very much !

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PREFACE

The construction industry is the second largest sector in Pakistan's economy after agriculture. It is a fragmented industry which includes very small and very large contracting groups. It includes professional groups such as architects, engineers, management personnel etc. Major part of this industry is dominated by material's suppliers, vendors etc.

In the light of the developments which have taken place particularly over the last ten years, the study has covered the capacity of the construction industry in terms of estimated output, availability of manpower, demand and production of building materials , financial problems, credit, quality of work, the role of construction in the economy, the organizational structure of the industry, costs and price trends of material inputs, the effects of labor immigration and prospects for future developments & problems have been covered.

Using regression analysis, forecasting equations had been derived to estimate the demand for construction (in millions of Pakistan rupees) and materials like cement, steel and timber over the next five years.

Based on the past performance, this study gives a good idea of the present and future construction industry.

I hope this study will prove useful not only to persons and organizations related to the construction industry, but also to the engineering students.

Tayyab A. Ansari

LIST OF FIGURES

NOMENCLATURE

GDP	Gross domestic product
GDP-1	Gross domestic product lagged by one year
GNP	Gross national product
GDCF	Gross domestic capital formation
GDCF(T)	Gross domestic capital formation (Total)
GDCF(C)	Gross domestic capital formation (Construction)
VAC	Value added in construction
Pak.	Pakistan
Rs.	Rupees
Const	Construction
YR	Year
LF	Labor force
CM	Cubic meter
cy	Current year
py	Previous year

INTRODUCTION

BUILDING INDUSTRY AND BUILDING MATERIALS IN PAKISTAN

Until about 1971, there were very few private developers in Pakistan. Housing for public sector was done by the Provincial and Central Works departments through contractors, while the entrepreneurs constructed their residences mostly with the help of unqualified but skilled persons. After 1971, when land was made available in the city of Karachi by Karachi Development Authority (KDA) and larger allocations were made by the Government of Pakistan to House Building Finance Corporation (HBFC), a number of entrepreneurs, industrialists, businessmen, importers, consultants, etc., entered the building industry. Some of them had experience in building construction while others had neither enough managerial capability nor the sufficient technical knowledge. The building construction industry did, however, get a boost. The builders and developers have formed an association called " Association of Builders & Developers " which appears to be organized along sound lines. This association had to face several problems in various areas such as dealing with authorities responsible for approving building plans, sale prices, conditions of

sale, grant of house-building loans and so forth. The association, for these and several other reasons, made no serious effort to improve the building construction techniques and wasteful construction methods. A few attempts to rectify and enhance the Building Systems could not be successful as these were applied without the adaptations necessary to make them suitable under the existing conditions prevailing in this country.

By and large, the building industry in Pakistan is fragmented. The industry is faced with the shortage of skilled labor and technicians, non availability of good aggregate, shortage of good timber, occasional shortage of cement, good aggregates and indifferent quality of building hardwares, etc.

Employment opportunities and salaries offered by rich oil producing Middle East countries, have all but depleted the local market of skilled labor and technicians. Expansion in training facilities in the various building trades have been far outpaced by the demand. Building works, therefore, are at present executed mostly by semi-skilled workers. This adversely affects the quality.

In the private sector, which is responsible for a major portion of Urban Housing, there are a limited number of aggregate suppliers who wash, grade and sell properly graded aggregates for concrete work. There are also very few ready-mixed concrete plants for which concrete of desired strength can be obtained. There is a great need for such plants in big cities.

Almost as much cement is produced in the country, as imported. The quality of imported cement varies with its origin and the time-lag between the loading of the ship and disembarkment at the port. New cement factories are being established and the shortage is expected to be considerably mitigated after a few years. However, in a country like Pakistan, which is plagued with huge shortages in the balance of payment, it is essential that efforts are made to reduce cement consumption in building construction. Plenty of suitable lime-stone and gypsum is available in the country. At present, lime is produced in cottage industry and is inconsistent in quality. Gypsum is rarely used and that too, mostly for decorative purposes although it can easily replace a considerable quantity of cement if used for internal plaster.

Reinforcement bars are rolled in mills which utilize iron scrap from ship-breakers. The resulting reinforcement bars are of non-uniform sections and varying strengths. Uniform quality of steel reinforcing bars are available from only a limited number of mills.

Supply of building hardware is also limited to few a industries.

Most of the steel doors and windows are manufactured in workshops which are not substantially equipped to ensure desirable tolerances and consistent use of proper quality of steel sections.

There has been considerable acceleration in building construction in the urban areas during the last decade. While the capital outlay has increased four-fold, most of it has been absorbed by inflation and the percentage increase in real terms has been at the most, 100%. The rate of construction, as currently estimated, is a fraction of the additional demand due to the rate of urbanization. It is roughly estimated that the shortage of urban housing is growing at a rate of 80,000 units per annum.

There is, therefore an imperative need to organize the building industry on proper lines, augment the men and material resources, search for improved methods of construction, and study, learn & adapt from the experiences gained by the developed and developing countries so that the financial allocations made for the buildings are utilized to the best advantage.

The government of Pakistan has taken certain policy decisions in this regard. Relevant extracts from the "Pakistan economic survey" are reproduced below :

Policy decisions

To solve the problems such as wasteful expenditure in the construction, high cost of building materials & construction and limited number of loans available for housing, the following major decisions were taken by the government :

* In order to discourage luxury housing and to make optimum use of scarce urban land , the maximum size of the plots have been fixed to 600 sq. yards throughout the country.

* Loaning procedures of the House Building Finance Corporation have been simplified and commercial banks are allocating substantial funds for providing building loans.

* Standard plot sizes for low cost schemes throughout the è country have been approved by the government. In order to make optimum use of all available resources and to facilitate speedy construction, a nationwide architectural competition to select building designs on standard plots is being arranged by the Environment and Urban Affairs Division. The competition will be held in two stages: in the first stage, all the interested architects will be asked to submit their designs on standard residential buildings . Then, in the second stage, the selected ones will prepare detailed working drawings and bill of quantities, etc. The standard house plans along with details will be sent to the concerned organizations for printing these in the form of booklets and making it available to the public at nominal cost.

* Various proposals for the introduction of pre-fabricated buildings in the country are being examined. Basic parameters for introducing pre-fabricated systems are the maximum use of local skills and building materials. The

government is encouraging the private sector in this direction. There is now a tendency towards vertical construction; such a step is very much desirable and indeed, feasible. In this connection, the government has taken decisions on the feasibility of consisting pre-fabricated buildings in the country.

* To encourage full participation of the private sector in the building construction activity, this has been declared as an industry. In this connection, a number of tax incentives have been provided and efforts are being made to provide more facilities to the sector through rebates in custom duties etc.

* Due to inadequacy of the traditional building techniques to meet the housing requirements in the country, pressure on urban land has necessitated vertical medium-size development. Also, with the increase in the cost of building materials like cement and steel, it has become inevitable to adopt modern construction techniques particularly pre-fabrication. Recognizing this need, the government has taken the following decisions towards

initiating pre-fabrication :

* Site facilities such as land, water and power will be provided.

* Regular and adequate supply of building materials such as cement and steel will be assured.

* The principal buildings will be standardized to facilitate their mass production.

The United Nations has shown interest in providing assistance for building projects in the country. Environment and urban affairs division is formulating a viable project which is the development of a model village near Islamabad in consultation with the Capital Development Authority.

A national building policy is currently under consideration which, in addition to other measures, incentives for establishing of building components factories to meet the objectives.

To tackle all the problems, beneficiaries from the building trade make an effort to solve at least some of the problems faced by the industry. Some of the suggested activities are enumerated below :

1. Training facilities should be provided to people in various trades by the builders.

2. The building industry should participate in the buildings research.

3. Installation of central ready-mix concrete plants.

4. Introduction of pre-cast building systems.

5. Use of lime and gypsum to cut cement expenditures.

HOUSING STRATEGY

Building / Housing scenario and existing conditions

Pakistan's total population has grown from 65.3 million in 1972 to 83.78 million in 1981 with annual population growth rate of 3 percent. At this growth rate, the total population of the country is estimated to be 113 million in 1990 and 120 million in the year 2000. The proportion of the urban population will increase from 28 percent (at present) to 33 percent by 1991 and 40 percent by 2000 at the current growth rate. On the other hand, based on the current population growth rate the estimated annual housing requirements of growing population are 120,000 and 190,000 units in the urban and rural areas respectively where as the current output is between 40,000 - 45,000 units in the urban areas and organized effort is lacking in the rural areas. Congestion in the existing housing has increased from 5.1 (persons per housing unit) in 1961 to 6.1 in 1981. The average number of persons per room has increased from 3.3 (in 1960) to 3.5 (in 1980). About 73 percent of the urban families had a ratio of 5 or more persons per room in 1980. According to Grimes Orville F. Jr., of "Housing For Low Income Urban Families " a World Bank Research Publication (John Hopkins University press, U.S.A., 1976)

"The ratio of percentage dwellings occupied with 3 or more persons per room is considered to be an indicator of overcrowding by the World Bank."

These ratios are extremely high even if compared with countries similar to Pakistan. Deficiency in Housing stock of an acceptable standard is thus evident.

Contrary to this, the housing sector in the past has been neglected and relegated to a very low priority because of financial constraints and consistent approach to deal with the shelter issues have not been evolved. Whenever budgetary cuts were imposed, the impact was on the housing sector and as such it has remained a depressed sector in the allocation of resources. "The public sector outlay for physical planning and housing sector", which incidentally includes investment in tourism and multi-sectoral projects related to water supply such as Dams, has been progressively declining. Needed investment from the private sector has not been forthcoming due to the monetary and fiscal policies. On the contrary, public sector outlay, in some other sectors of economy has increased, even though benefit-cost ratio of investment in those sectors may not be as high as compared with the housing sector if the social aspects of providing shelter are accepted as a positive contribution to well being of the population.

Questions have been raised regarding the place of housing in the national economy. There is a general view held that this sector is unproductive and inflationary. The actual experience in a number of countries including Pakistan indicates otherwise. The multiplier affect of investment cannot be ignored.

Projection of future planning need

Development of detailed projections of housing needs is essential in framing the Building/Housing strategy. A perusal of planning documents indicates statement of urban housing backlog (the figures range from between one and two million housing units) and the incremental demand created by the growth of population. Whereas projections of the incremental demand are reasonably accurate, there is no basis of computation of the backlog. It is felt that a reference to the backlog is irrelevant since :

* A shelter of one kind or the other has been found.

* The unmet demand is reflected in the crowding conditions of the existing housing. Therefore, adopting a slightly different approach, the estimation of housing need has

been broken down into three categories:

1. Housing required to accommodate new housing.

2. Housing required for the replacement of the existing housing stock.

3. Housing required to reduce crowding.

Accommodation of new households

Assuming that the current population growth rate trends will continue through 1990s, and using 1.5 households per housing units in the urban areas and 1 household per unit in the rural areas, it is estimated that 120,000 and 190,000 additional housing units will be required annually in the urban and rural areas respectively.

Replacement of the existing housing stock

This aspect has been escaping attention in the past and looking at the previous years, one does not see any reflection and emphasis on the need to preserve the existing housing stock. This is a fundamental issue. According to the 1980 housing census, 20 percent of the existing housing

in Pakistan had a life span of 34 years or more. This cannot be left unattended. As a matter of policy, therefore, equal emphasis is necessary on new housing as well as maintenance of existing housing because otherwise, we are deliberately adding to the new housing demand. Broadly speaking this category can have two components:

1. Houses that are in such a poor condition that they are unfit for upgrading and therefore, must be replaced.

2. Houses that can still be upgraded and improved.

Two approaches can generally be applied to compute this component of housing need :

1. By assuming life of the house at 50 years at the end of
è which, it drops out of the housing stock and must therefore, be replaced, and

2. By assuming that each house has an indefinite life, as per maintaining a constant quality level.

Information is not available and therefore using the second approach, the figure works out to be 46,400 housing units annually in the urban areas.

Reduction in crowding

Crowding can result in inadequate housing even if the structure itself is physically sound and properly serviced. To remedy this situation, reduction in crowding is also seen as an additional new construction. Estimation of this requirement is difficult. To start with, a standard as an acceptable housing is to be prescribed. The general approach is applied in this situation. Person-per-room criteria has been used. The number of persons per room is also a widely recognized indicator of the housing conditions internationally. As indicated earlier, the level selected by United Nations and the World Bank to indicate overcrowding under any circumstances is 3 or more persons per room. The overall ratio in Pakistan is 3.5, 3.6 and 3.2 for the country, rural and urban areas respectively. Using the persons per room approach, the requirement of the additional housing works out as follows:

Country : 2.8 million housing units
urban areas : 315,000 housing units
Rural areas : 2.5 million housing units
The above figures indicate the requirements for the next five years.

The overall picture of total housing requirements during the next five years is:

	New housing	Replacement of existing stock	Reduction in crowd-ing.	Total
Urban areas	600,000	232.000	315,000	1,147,000
Rural areas	950,000	-	2,500,000	3,450,000
Total	1,550,000	232,000	2,815,000	4,597,000

The annual output is estimated to be between 40,000 - 45,000.

The following chapters will review in detail the performance of the construction industry in general and its behavior under changing factors and circumstances in particular.

CHAPTER 1

CONSTRUCTION AND THE NATIONAL ECONOMY

1.1 The construction industry is closely linked to the general state of the national economy. It is the largest single industry in the country after agriculture. It employs more people than any other single industry in both the formal modern sector and the informal, family owned small scaled sectors. It thus absorbs much of the surplus labor available in developing countries. It also accounts for the greater share of the value added and the gross domestic product in the national economy than any other single industry.

1.2 In the developed countries, economists have traced and quantified "long-term cycles" in the construction industry. And only in the long-term swings, those corresponding to the peaks and troughs of the long cycle, are the fluctuations in the construction activity. In short term movements of business activity, those running to only a year or two, the construction industry in developed countries appears to be one of the most stable sectors of the economy; or when it is changing rapidly, one of the most readily predictable. There is a high degree of continuity from year to year, so that the pattern of the change in any year tends to resemble that of adjacent years.

1.3 In developing countries it is difficult to establish long-term cycles in the construction industry just as it is difficult to establish long-term business cycles in general. In most of the developing countries the process of industrialization is of relatively recent origin. Therefore the idea of long-term development in these countries is more or less inapplicable. The general path to economic development in developing and underdeveloped countries is very different from that of developed nations. It is, therefore, not surprising to find that construction activity tends to fluctuate more from year to year in underdeveloped countries than in developed countries. This makes short term forecasting more difficult and complex. These fluctuations in construction activity from year to year may also affect business activity in general since construction contributes a very significant share of the total value added in industry and gross national capital formation of underdeveloped countries.

1.4 CONSTRUCTION AND MACRO-ECONOMIC INDICATORS

Construction as a component of GDP

A study by the Planning Division, Government of Pakistan indicates strong linear correlation between the logarithm of per capita value added by construction and the

logarithm per capita gross domestic product (GDP). The study indicates some very interesting results. Appropriately adjusted data for two five year periods 1955-60 and 1960-65 for 75 countries in different per capita income groups, shows a strong linear correlation between the logarithm of per capita value added by construction and the logarithm of per capita GDP.

The relevant regression equations were :

1955-60	Log Y = 1.18 Log X - 1.72
	No. of observations 62
	r = 0.88
1960-65	Log Y = 1.25 Log X - 1.94
	No. of observations 76
	r = 0.93

Where :

Y = Per capita value added by construction

X = Per capita GDP

r = Correlation Coefficient

1.5 These equations indicate also that the share of construction in GDP tends to increase with increase in per capita GDP. The study indicates that the countries in the highest income groups show a very consistent pattern of growth between the two five year periods, with value added by construction increasing faster than per capita GDP. It is interesting to note, however, that for less developed countries in the lower per capita income ranges, there was no consistent pattern; in some countries the share of construction actually decreased over the period under review, whereas in others it increased, sometimes fairly rapidly. In most of the cases the value added by construction was between 3% to 5% of GDP for underdeveloped countries and between 5% to 9% for developed countries.

Pakistan : The same hypothesis was tested for Pakistan and there appeared to be no relationship between the growth rate of per capita value added in construction in any given year and per capita GDP growth rate over the same year.

1.6 The following table shows the share of value added by construction to the Gross Domestic Product in Pakistan.

Table 1.1

GDP and VAC in millions of Pak. Rs. (1960 prices)

Year	GDP	Value added Construction	Value added % of GDP	% Growth (VAC)
1949-50	12,398	179	1.4	---
1950-51	12,881	187	1.5	+ 4.5
1951-52	12,647	247	2.0	+ 32.1
1952-53	12,865	262	2.0	+ 6.1
1953-54	14,180	283	2.0	+ 8.0
1954-55	14,468	289	2.0	+ 2.1
1955-56	14,978	323	2.2	+ 11.8
1956-57	15,424	337	2.2	+ 4.3
1957-58	15,815	386	2.4	+ 14.5
1958-59	16,680	459	2.8	+ 18.9
1959-60	16,826	427	2.5	- 7.0
1960-61	17,649	612	3.5	+ 43.3
1961-62	18,710	596	3.2	- 2.6
1962-63	20,056	700	3.5	+ 17.4
1963-64	21,356	897	4.2	+ 28.1
1964-65	23,360	1,029	4.4	+ 14.7

Table 1.1 continued.....

Year	GDP	VAC	VAC % of GDP	% Growth (VAC)
1965-66	25,126	1,079	4.3	+ 4.9
1966-67	25,901	1,039	4.0	- 3.7
1967-68	27,659	1,037	3.8	- 0.2
1968-69	29,454	1,317	4.5	+ 27.0
1969-70	32,337	1,357	4.2	+ 3.0
1970-71	32,736	1,390	4.2	+ 2.4
1971-72	33,495	1,163	3.5	- 16.3
1972-73	35,773	1,346	3.8	+ 15.7
1973-74	38,439	1,490	3.9	+ 10.7
1974-75	39,930	1,754	4.4	+ 17.7
1975-76	41,229	2,094	5.1	+ 19.4
1976-77	42,401	2,076	4.9	- 0.9
1977-78	45,704	2,248	4.9	+ 8.3
1978-79	48,258	2,371	4.9	+ 5.5
1979-80	51,824	2,644	5.1	+ 11.5

Table 1.1 continued.....

Year	GDP	VAC	VAC % of GDP	% Growth (VAC)
1980-81	55,177	2,749	5.0	+ 4.0
1981-82	59,052	2,836	4.8	+ 3.2
1982-83	62,833	3,175	5.1	+ 11.9
1983-84	65,606	3,727	5.7	+ 17.4
1984-85	71,499	3,838	5.4	+ 2.9
1985-86	76,686	4,217	5.5	+ 9.9
1986-87	82,085	4,692	5.7	+ 11.3

Table 1.1a

Average growth percent per year

Year	Growth %
1950 to 1960	9.5
1960 to 1970	13.2
1970 to 1980	7.4
1980 to 1987	6.1

1.7 Table 1.1 shows the average share of construction in the GDP of Pakistan by year. Except for 1959-60, 1961-62, 1966-67, 1971-72 and 1976-77, VAC has increased each year from 1949-50 to 1969-70. The Growth rate increased from 9.5% in the first decade to 13.2% in the second. It continued to fall from 7.4% in the third decade and holds at approximately 6% at present. It may be noted that there has been significant fluctuations in the construction activity which were the result of economic as well as political circumstances. During particular years the construction activity rose abnomaly high. It may be noted that all the above results were obtained on the basis of 1959-1960 prices.

Refer to the following figures for values of Gross domestic product, relation between Gross domestic product and Value added in construction, Value added in construction as percentage of Gross domestic product and percent growth in the Value added in construction.

Figure 1.1a
GDP WITH TIME AT 1959-60 PRICES

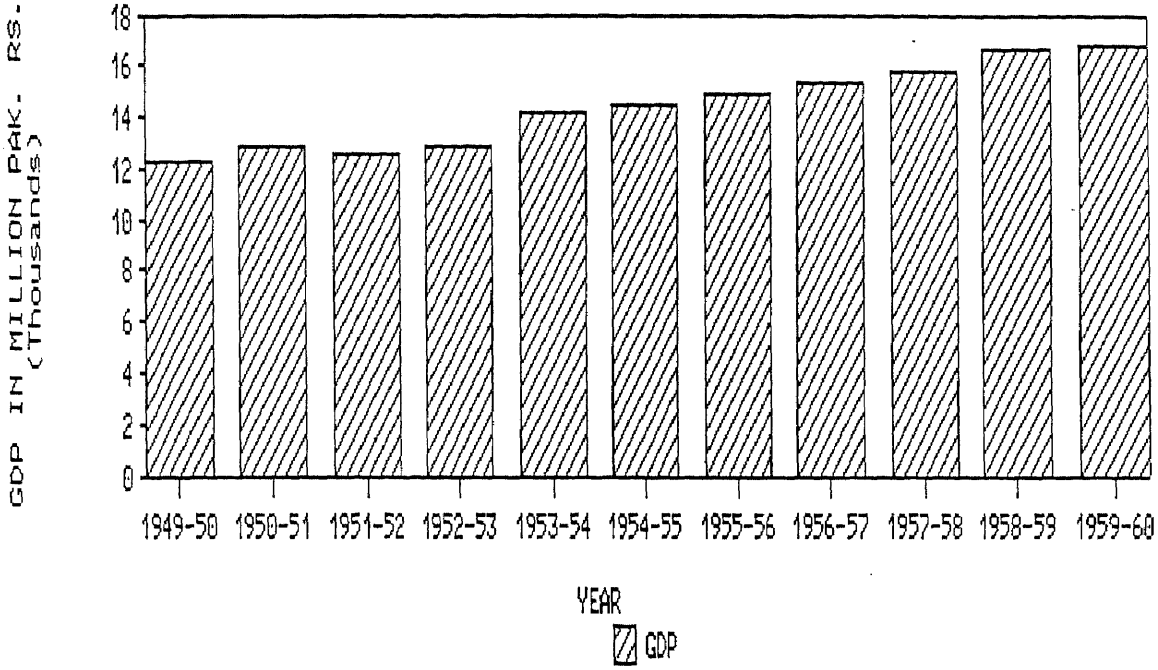


Figure 1.1b
GDP WITH TIME AT 1959-60 PRICES

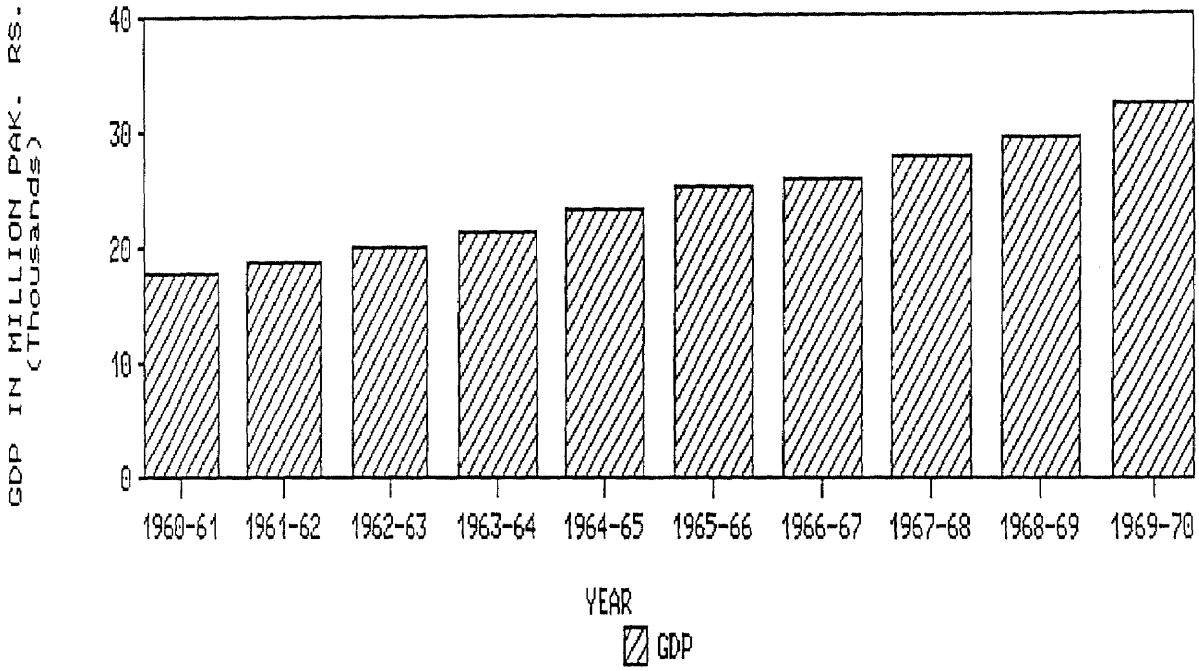


Figure 1.1c
GDP WITH TIME AT 1959-60 PRICES

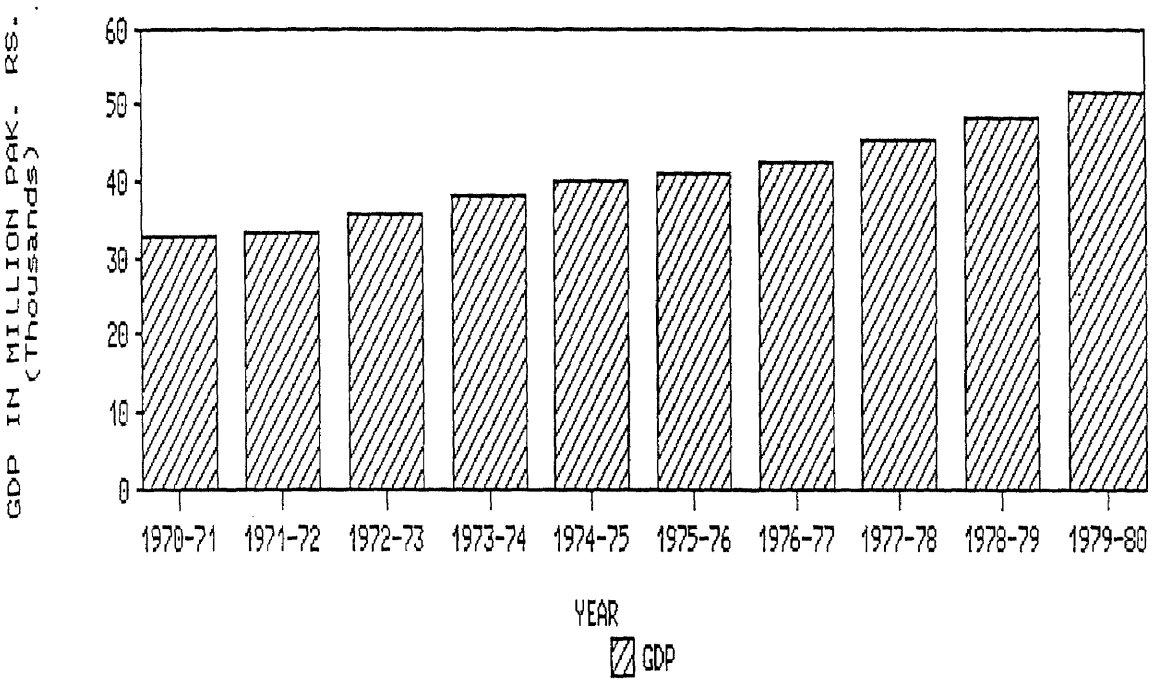


Figure 1.1d
GDP WITH TIME AT 1959-60 PRICES

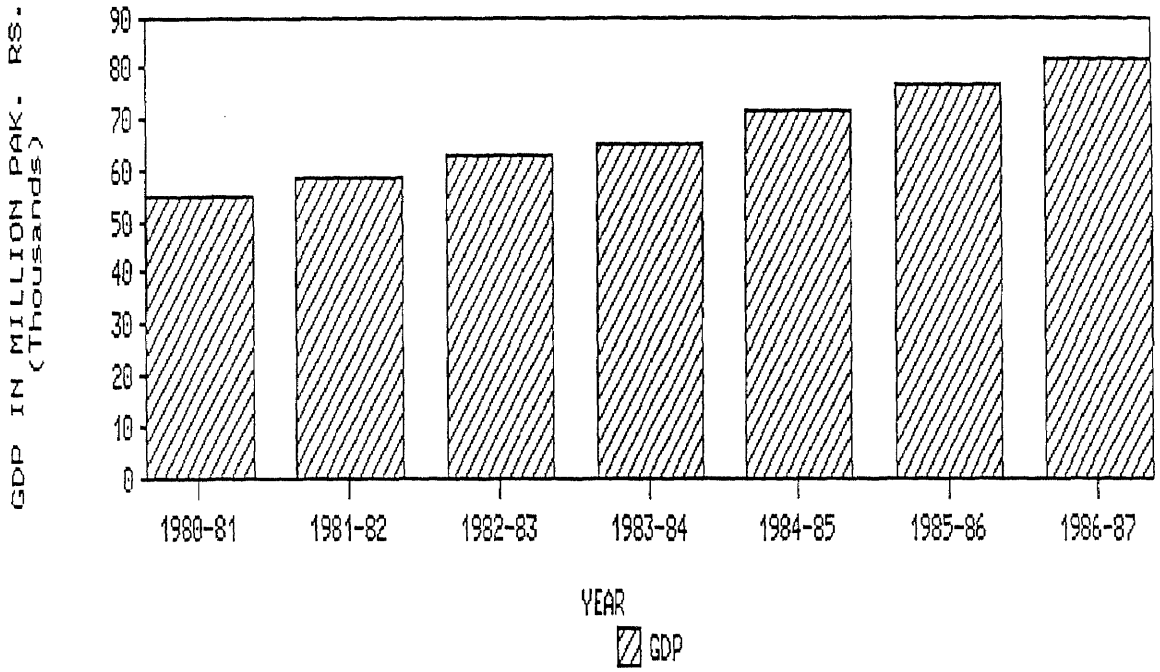


Figure 1.2a
GDP AND VAC WITH TIME AT 1959-60 PRICES

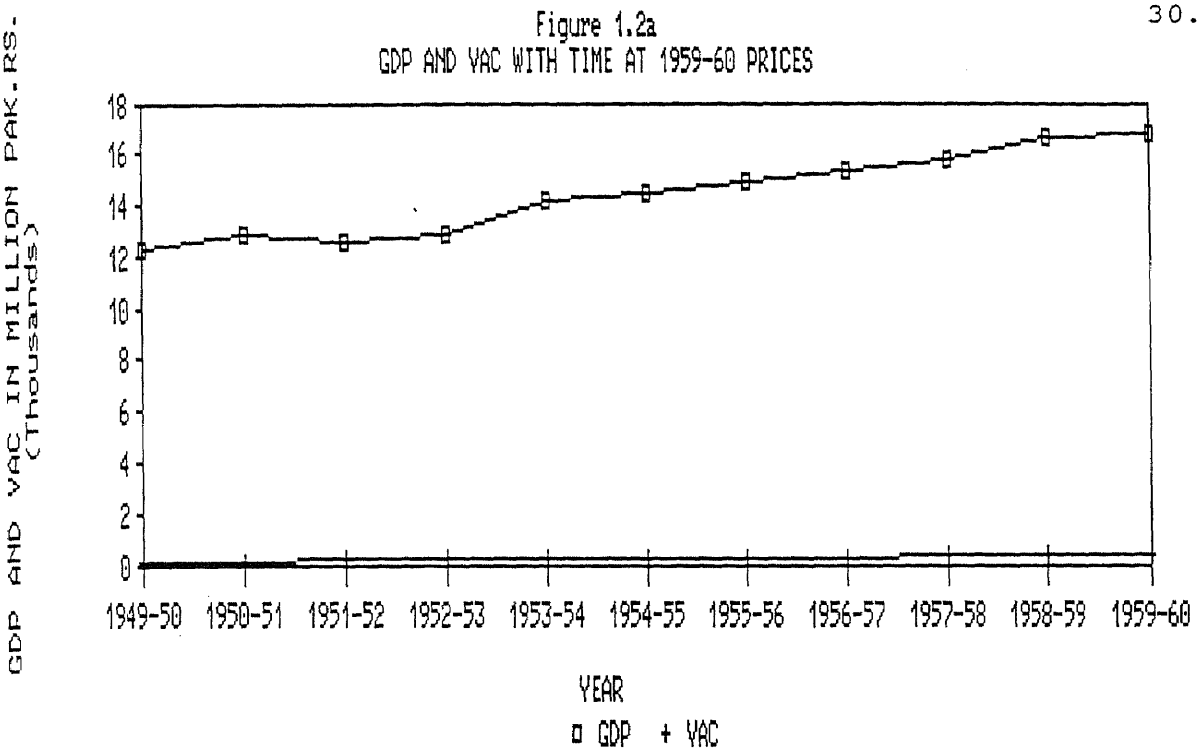


Figure 1.2b
GDP AND VAC WITH TIME AT 1959-60 PRICES

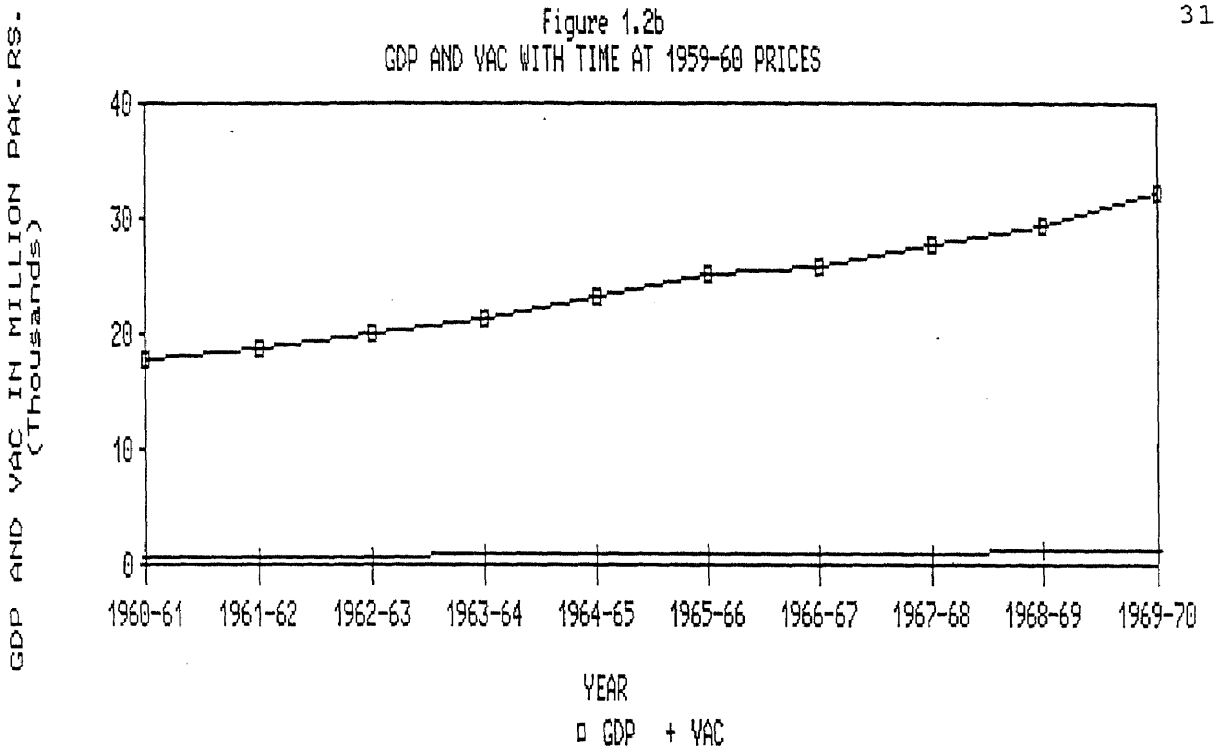


Figure 1.2c
GDP AND VAC WITH TIME AT 1959-60 PRICES

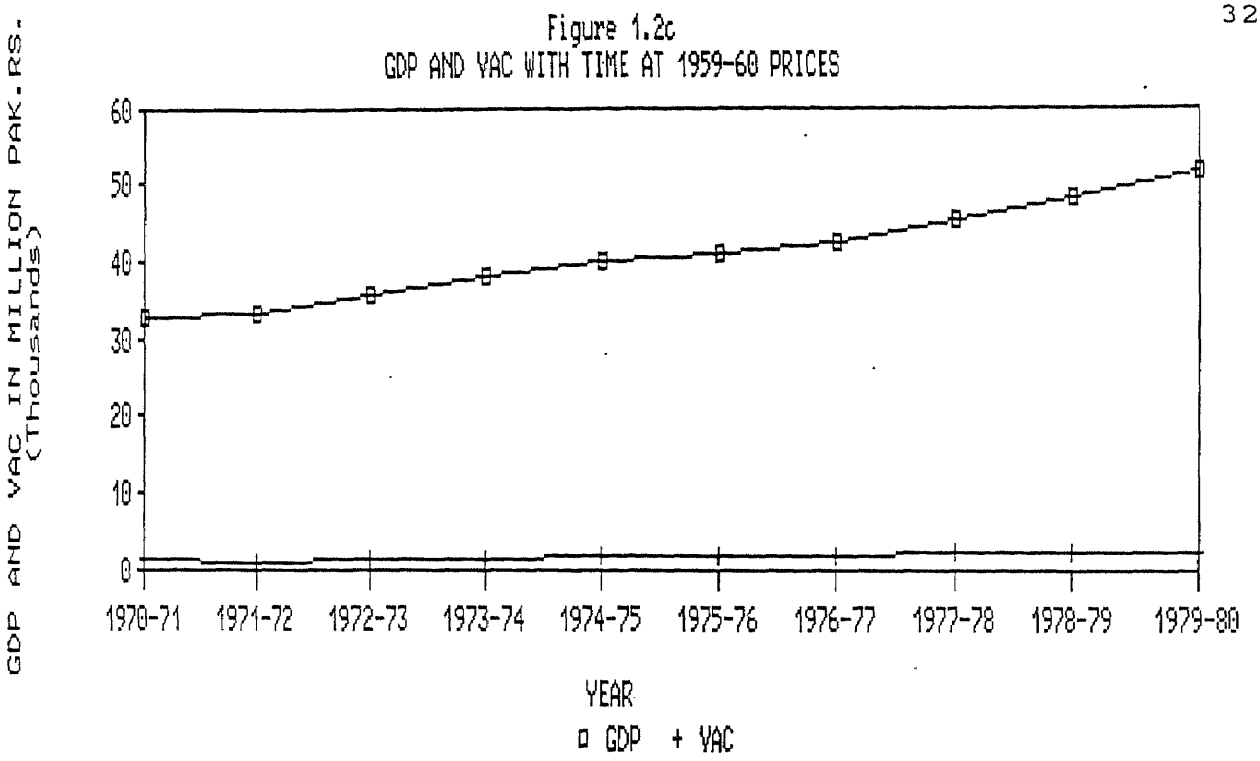


Figure 1.2d
GDP AND VAC WITH TIME AT 1959-60 PRICES

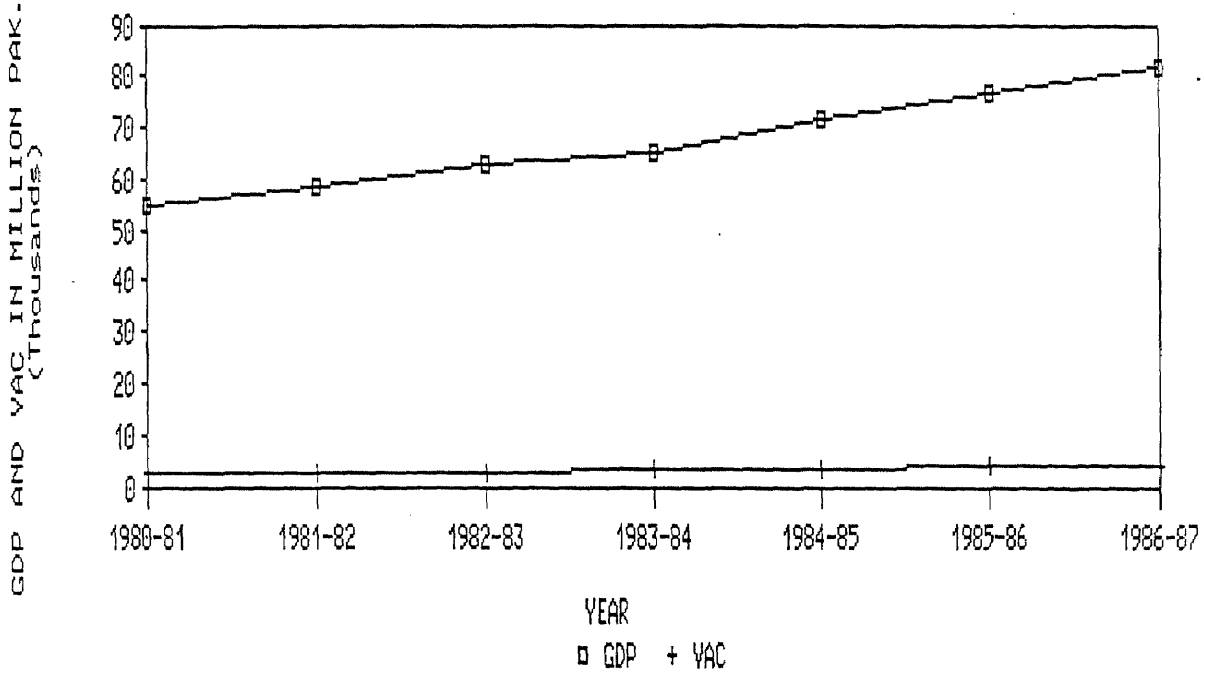


Figure 1.3a
PERCENT GROWTH IN VAC WITH TIME

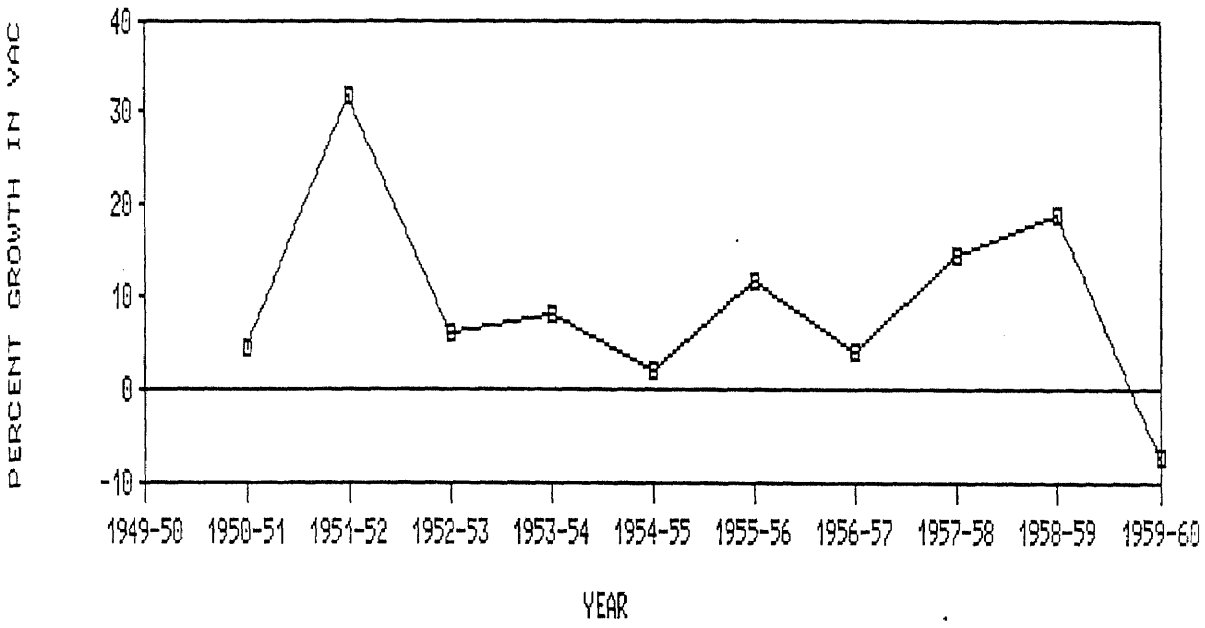


Figure 1.3b
PERCENT GROWTH IN VAC WITH TIME

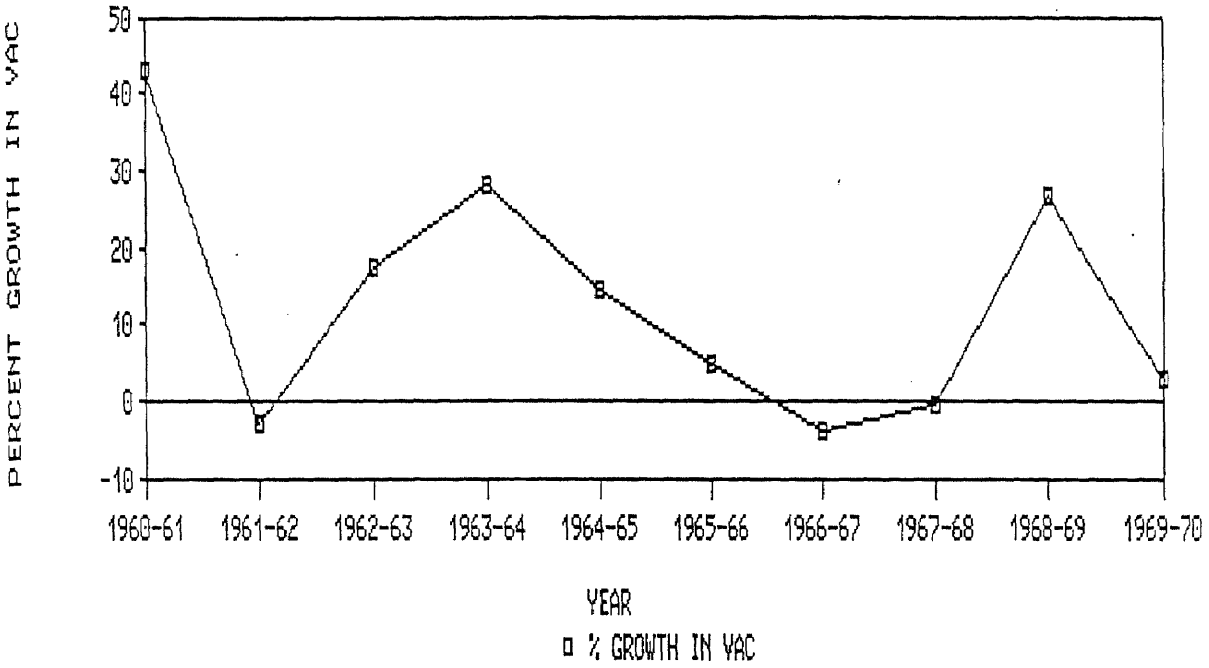


Figure 1.3c
PERCENT GROWTH IN VAC WITH TIME

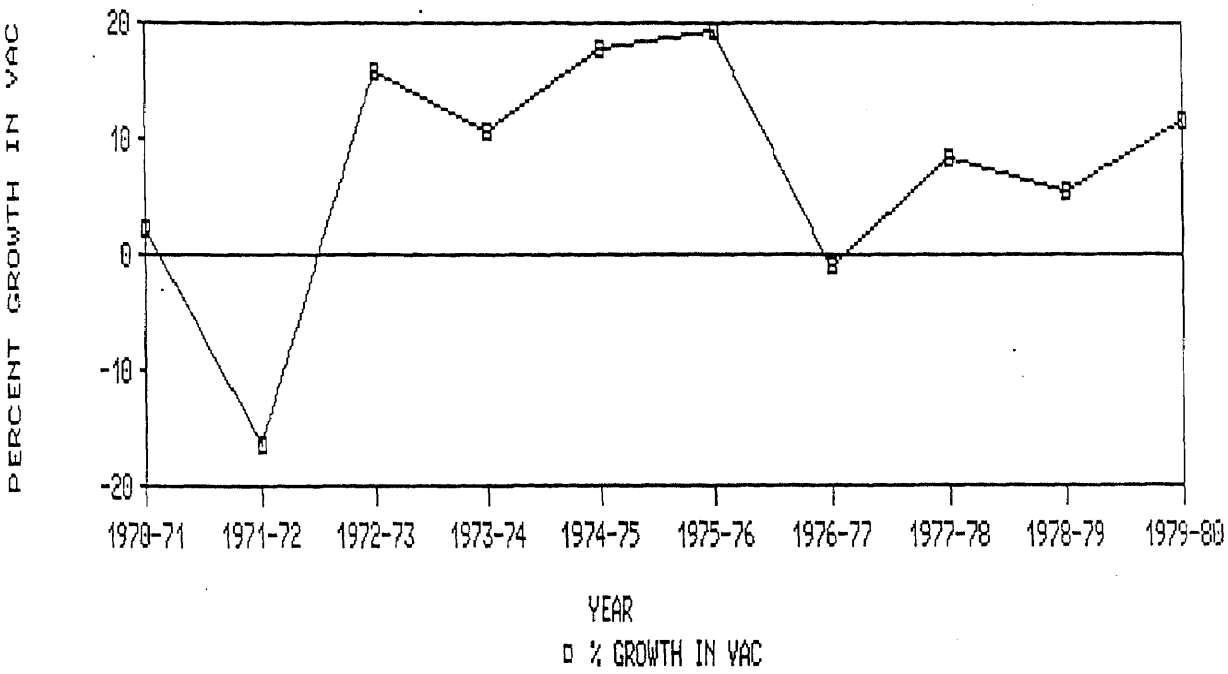


Figure 1.3d
PERCENT GROWTH IN VAC WITH TIME

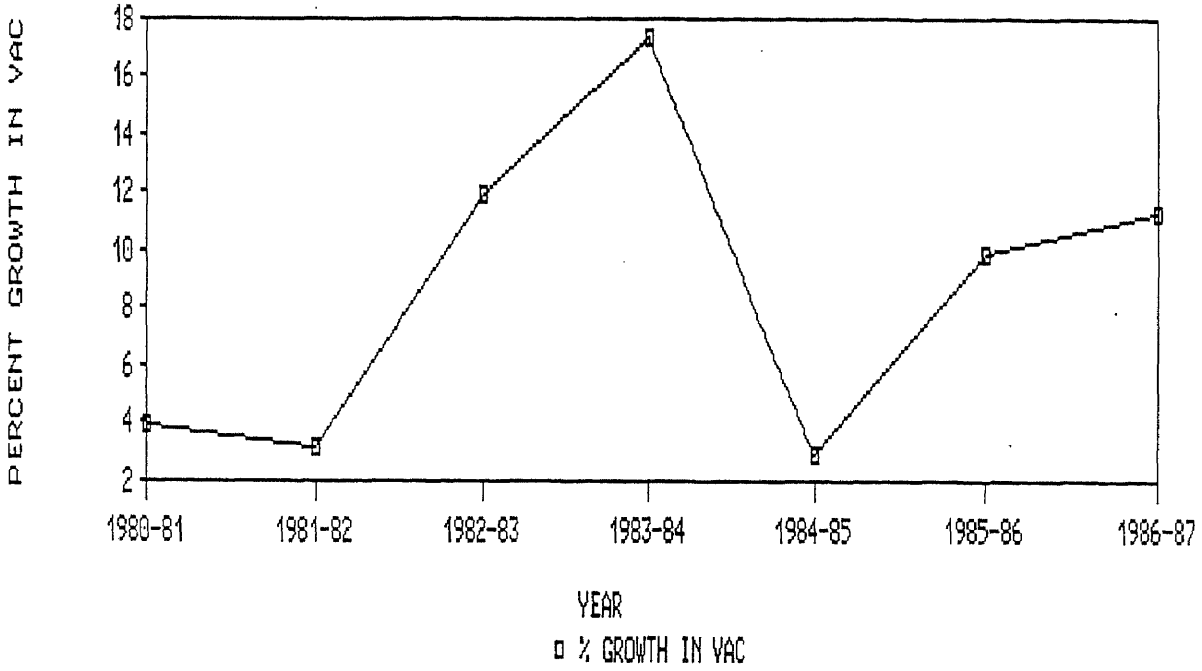


Figure 1.4a
VAC AS PERCENT OF GDP WITH TIME

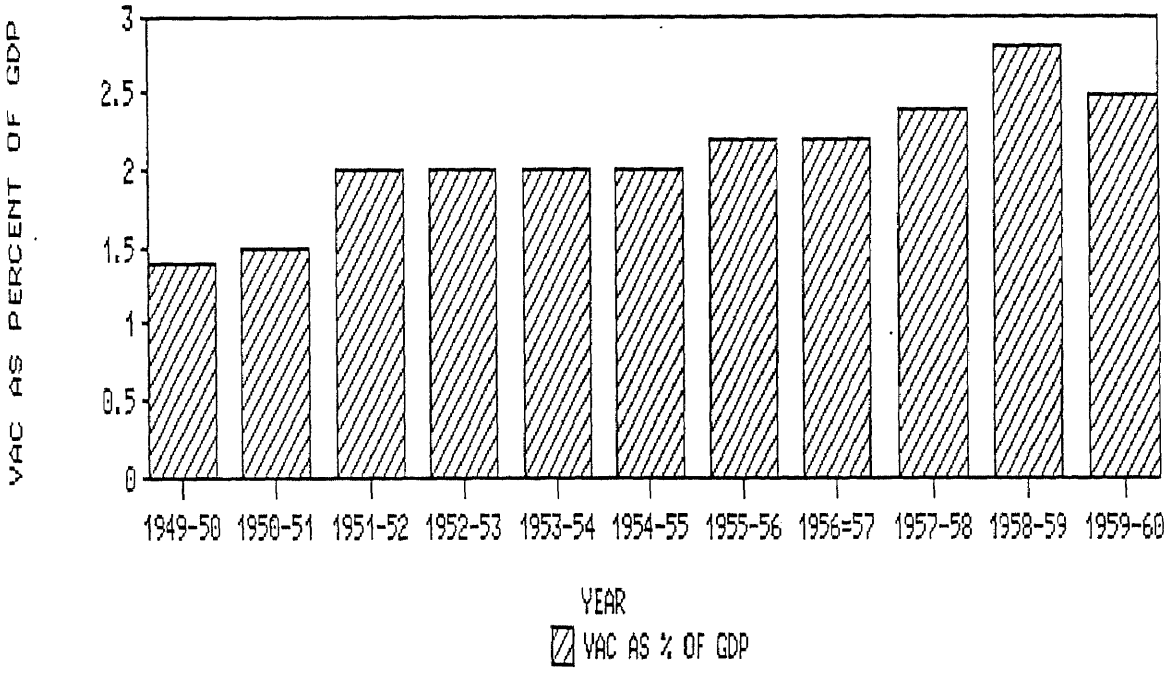


Figure 1.4b
VAC AS PERCENT OF GDP WITH TIME

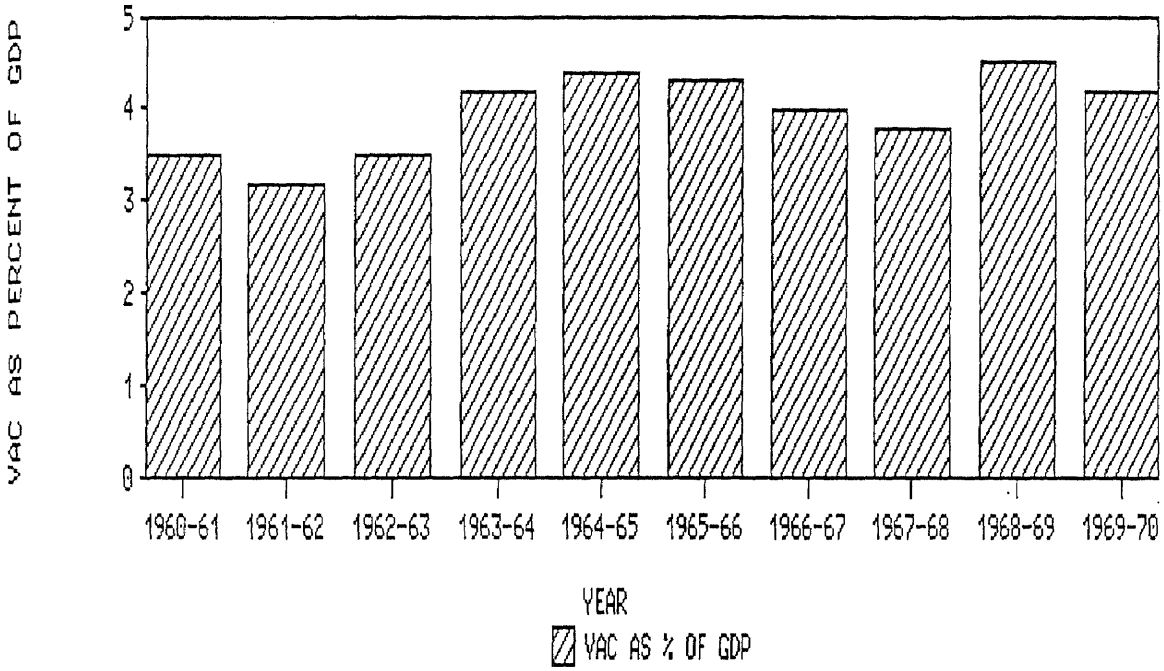


Figure 1.4c
VAC AS PERCENT OF GDP WITH TIME

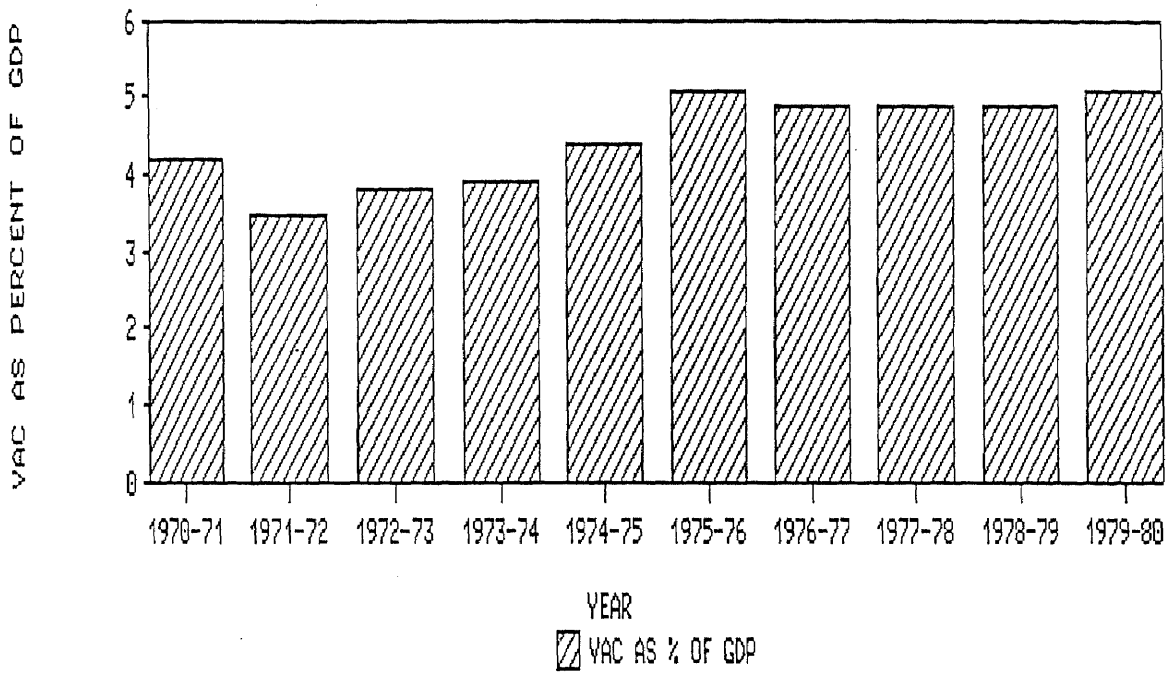
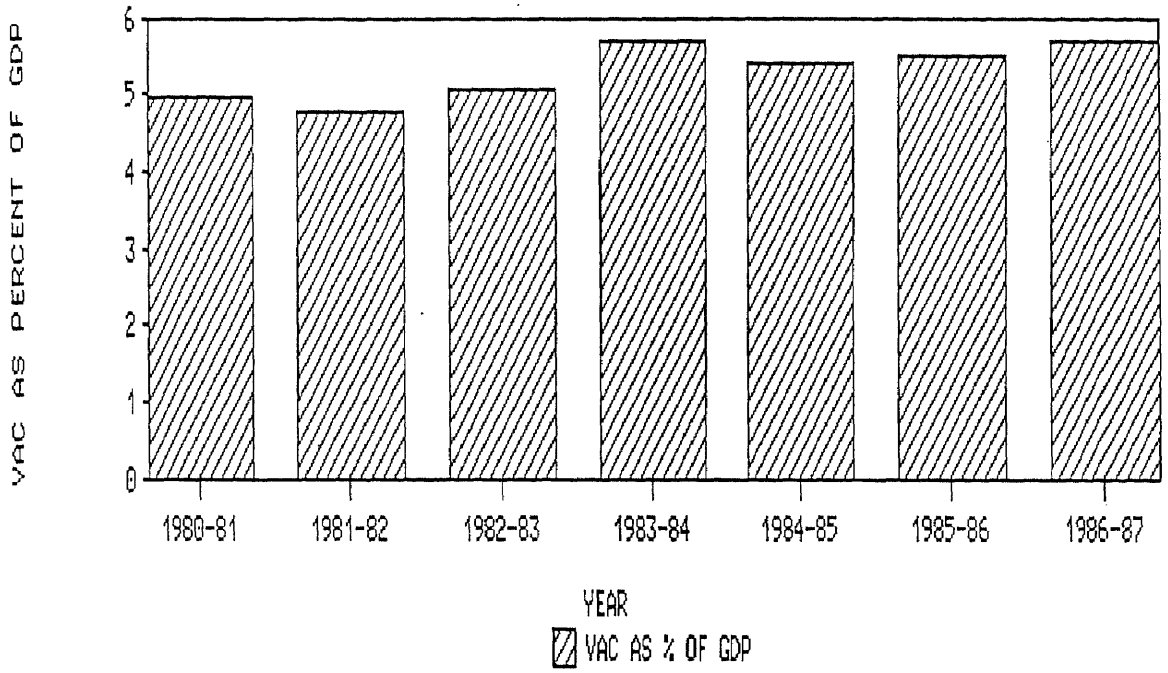


Figure 1.4d
VAC AS PERCENT OF GDP WITH TIME



1.8 The following table (Table 1.3) shows the share of value added by construction to Gross Domestic Product in Pakistan considering the current prices.

TABLE 1.3

GDP and VAC in millions of Pak. Rs. (current prices)

YEAR	GDP	Value added in construction	Value added % of GDP	% Growth (VAC)
1960-61	18,349	607	3.3	---
1961-62	19,139	602	3.2	- 0.8
1962-63	20,489	739	3.6	+22.8
1963-64	22,945	960	4.2	+29.9
1964-65	26,202	1,103	4.2	+14.9
1965-66	28,969	1,216	4.2	+10.2
1966-67	32,622	1,216	3.7	0.0
1967-68	35,542	1,262	3.6	+ 3.8
1968-69	37,985	1,709	4.5	+35.4
1969-70	43,347	1,822	4.2	+ 6.7
1970-71	46,006	1,979	4.3	+ 8.6
1971-72	49,784	1,763	3.5	-10.9
1972-73	61,414	2,298	3.7	+30.3
1973-74	81,690	3,114	3.8	+35.5
1974-75	10,3557	4,996	4.8	+60.4

Table 1.3 continued.....

YEAR	GDP	Value added by Const.	Value added % of GDP	% Growth (VAC)
1975-76	11,9736	4,718	3.9	- 5.6
1976-77	13,5982	5,694	4.2	+20.7
1977-78	15,9925	6,642	4.2	+16.6
1978-79	178,038	7,678	4.3	+15.6
1979-80	210,602	9,279	4.4	+20.9
1980-81	247,596	11,178	4.5	+20.5
1981-82	289,834	12,679	4.4	+13.4
1982-83	326,190	14,736	4.5	+16.2
1983-84	372,748	18,221	4.9	+23.6
1984-85	430,889	20,452	4.8	+12.2
1985-86	485,210	23,136	4.8	+13.1
1986-87	537,275	26,768	5.0	+15.7

The above results were obtained on the basis of the current prices.

Growth (VAC) = 100 * (VAC_{cy} - VAC_{py}) by divided VAC_{py}

Value added % of GDP = 100 * VAC_{cy} divided by GDP_{cy}

Where :

cy and py are current and previous year respectively.

Values of VAC and GDP were taken from economic survey

Figure 1.5a
GDP WITH TIME AT CURRENT PRICES

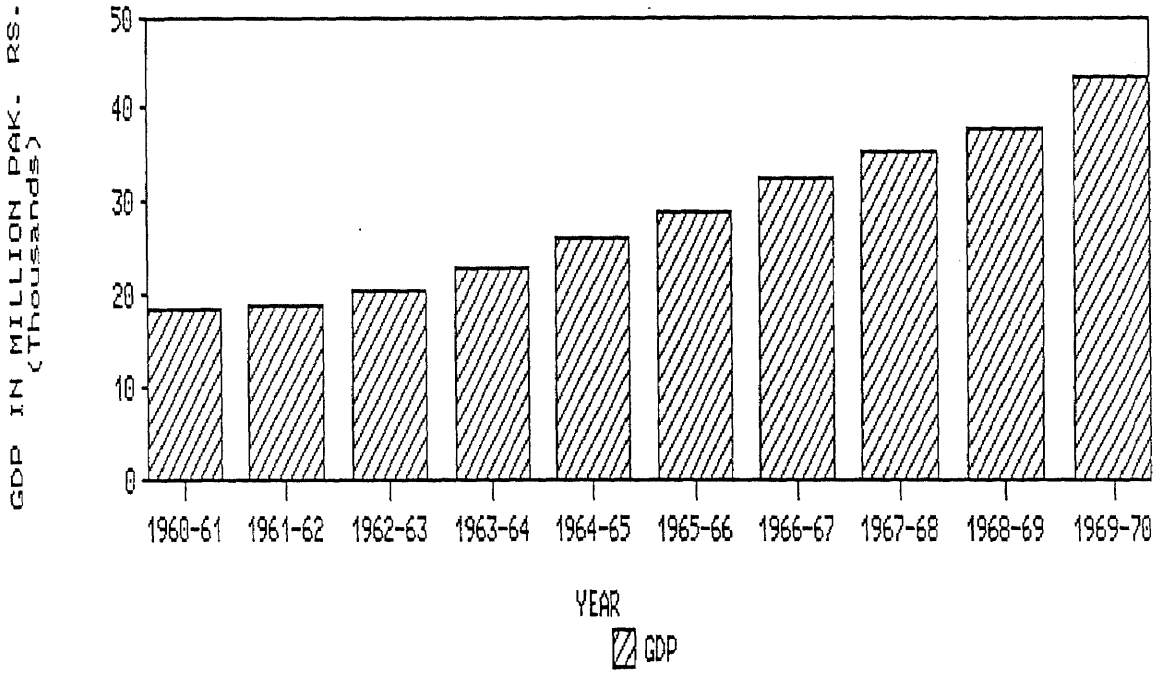


Figure 1.5b
GDP WITH TIME AT CURRENT PRICES

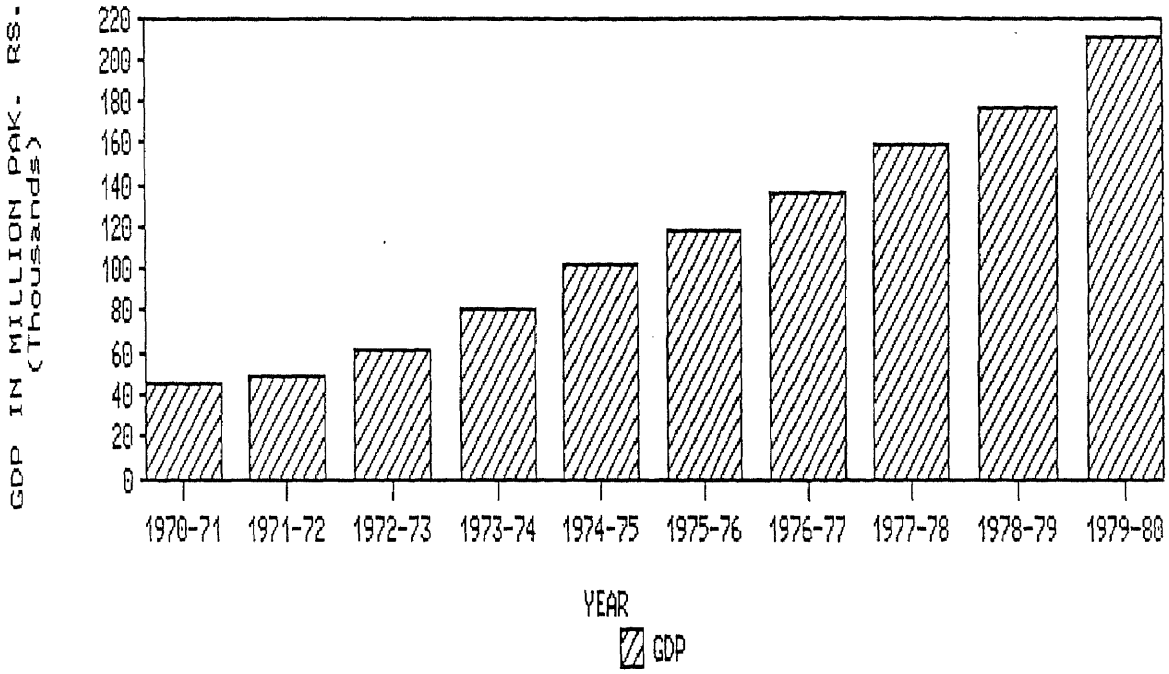


Figure 1.5c
GDP WITH TIME AT CURRENT PRICES

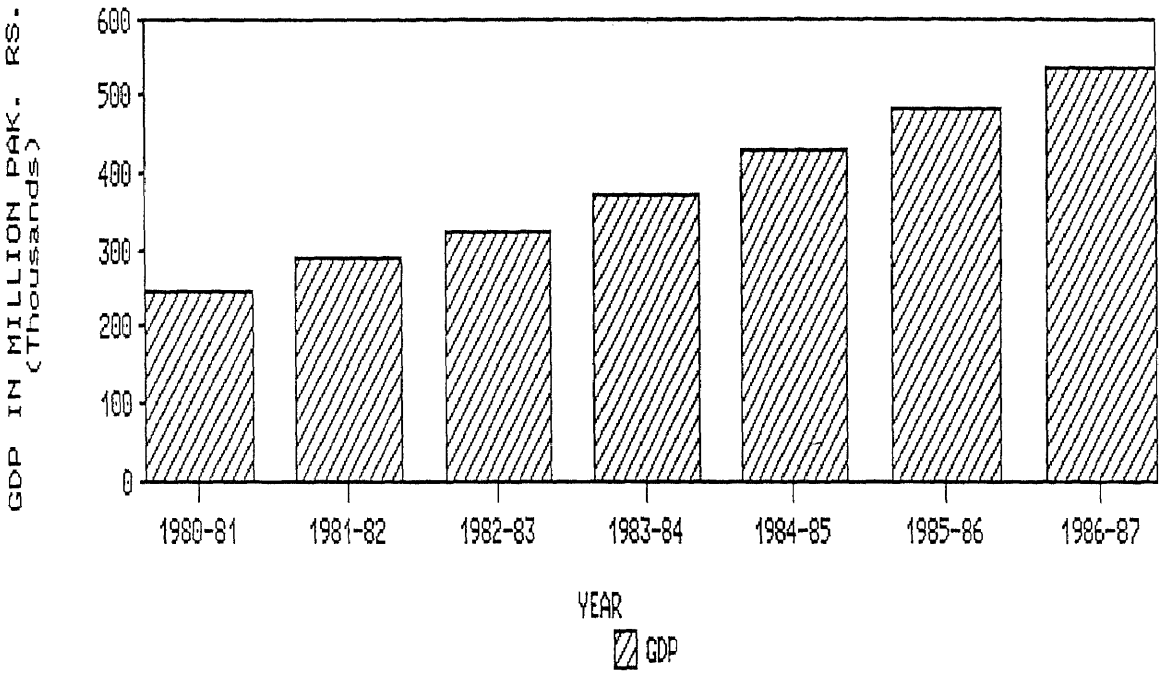


Figure 1.6a
GDP AND VAC WITH TIME AT CURRENT PRICES

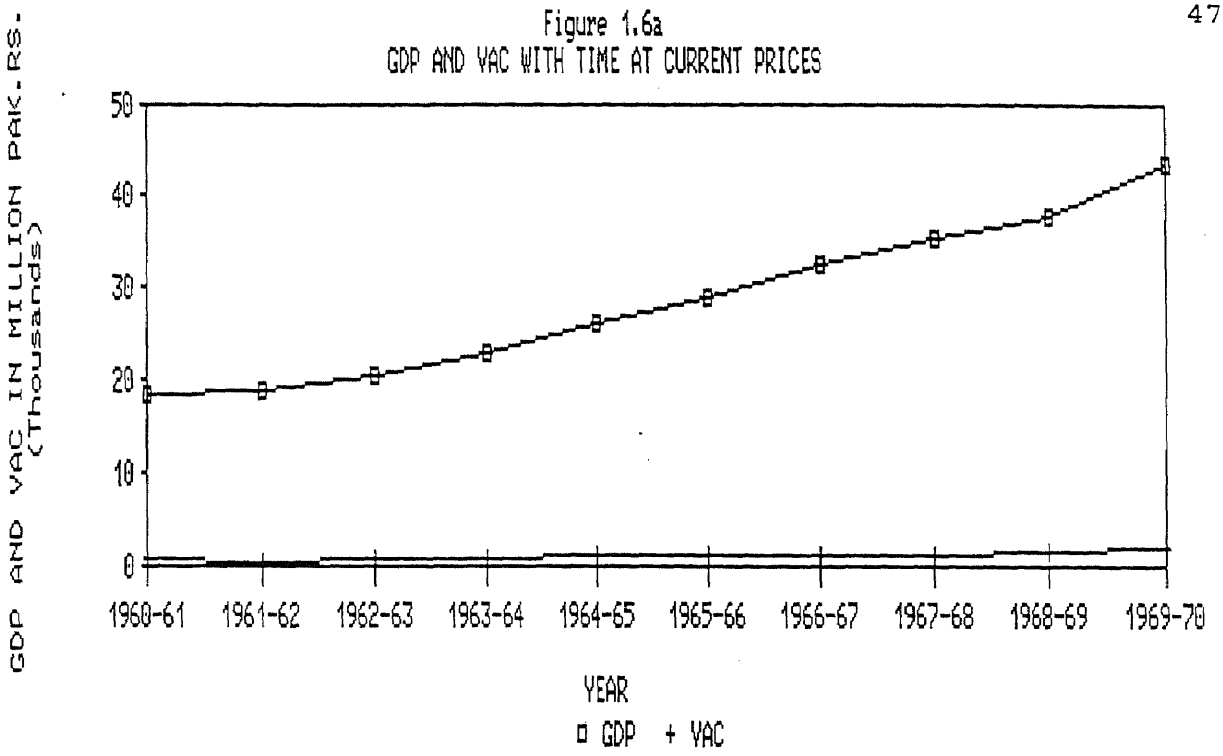


Figure 1.6b
GDP AND VAC WITH TIME AT CURRENT PRICES

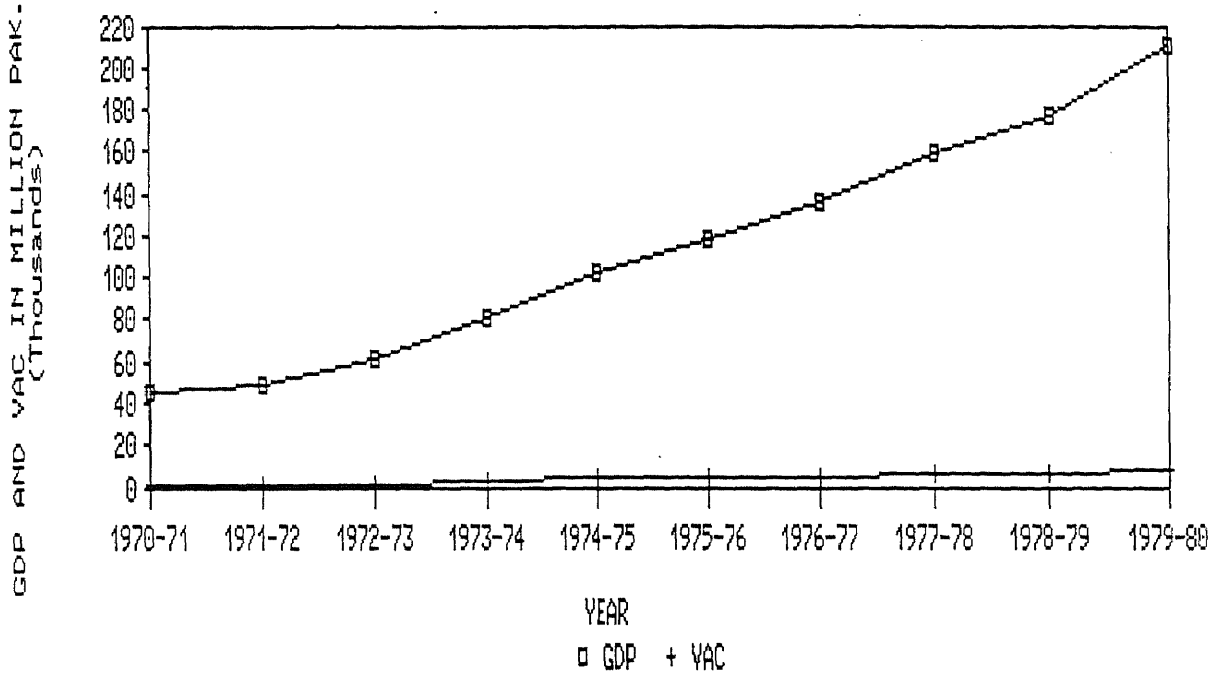


Figure 1.6c
GDP AND VAC WITH TIME AT CURRENT PRICES

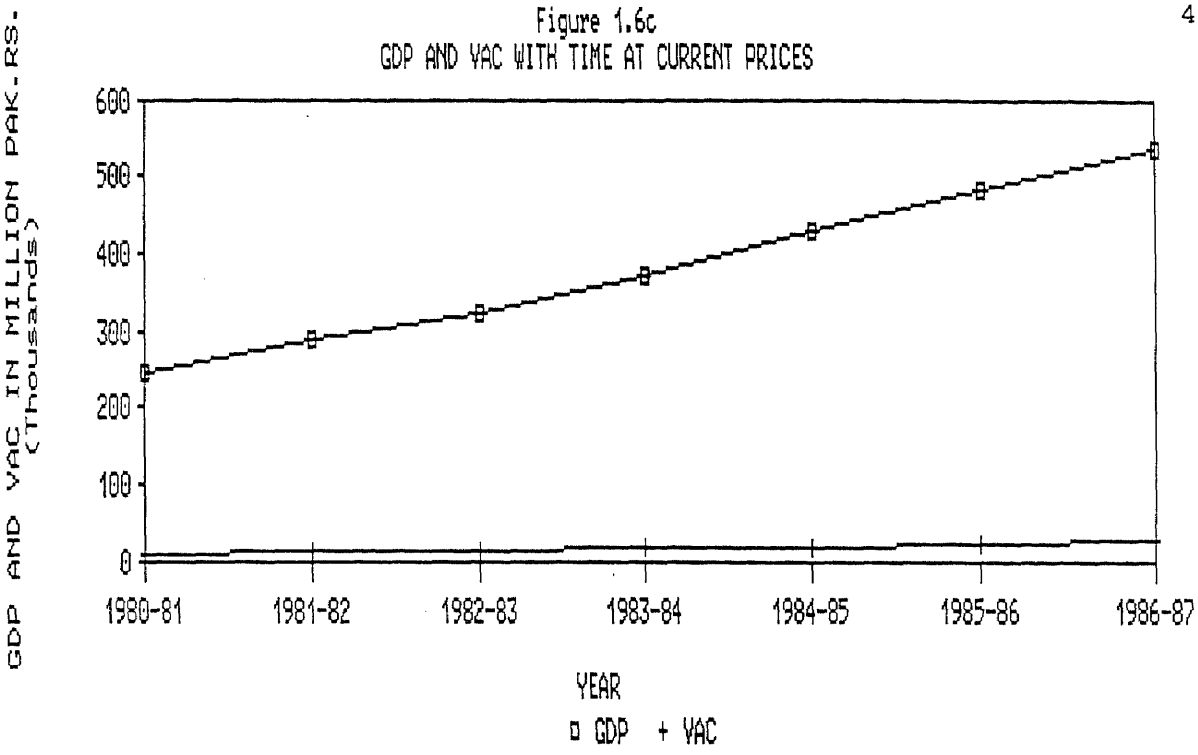


Figure 1.7a
PERCENT GROWTH IN VAC WITH TIME

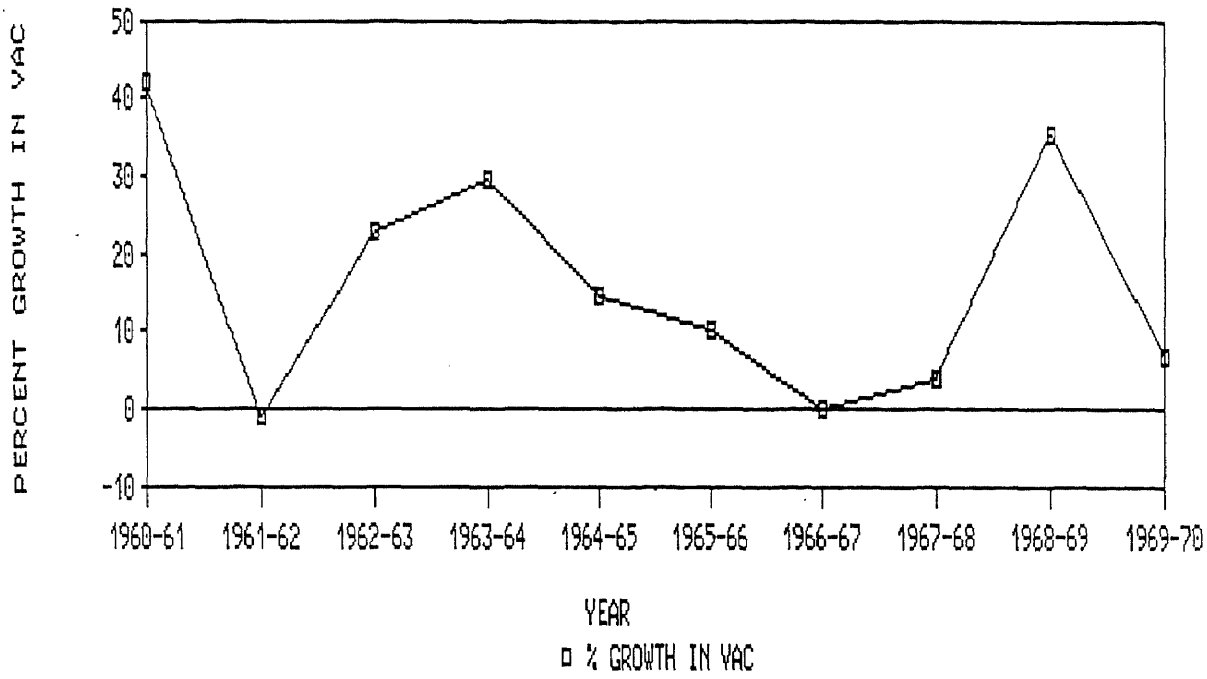


Figure 1.7b
PERCENT GROWTH IN VAC WITH TIME

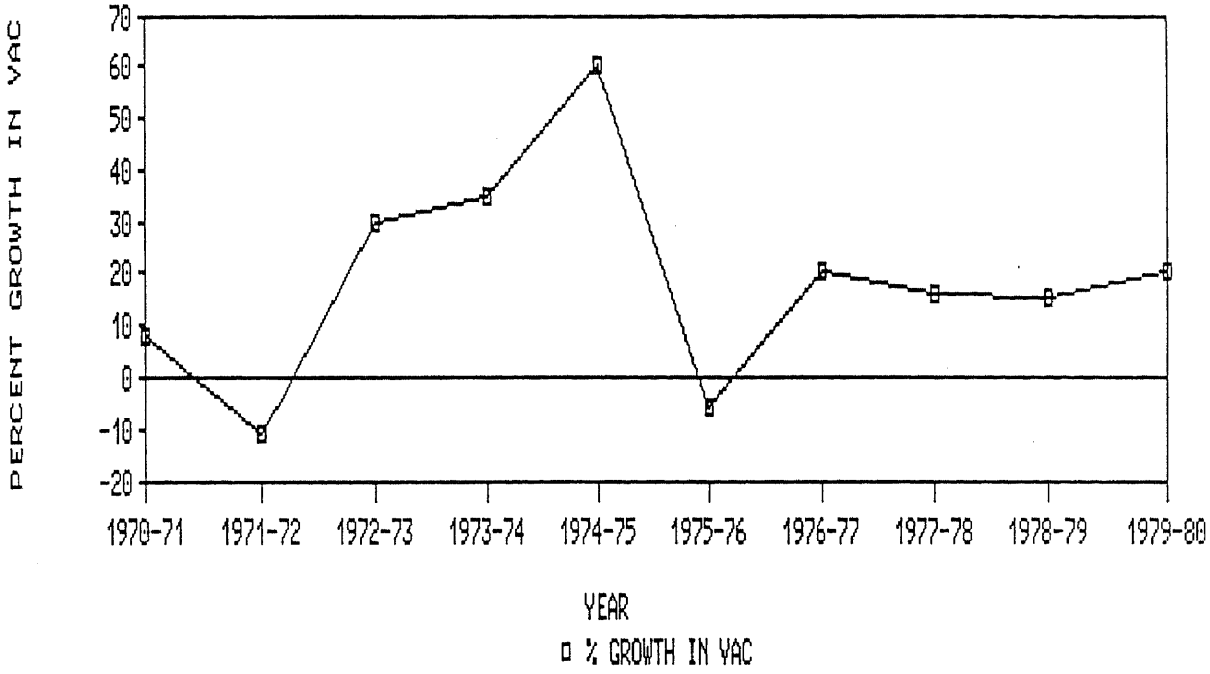


Figure 1.7c
PERCENT GROWTH IN VAC WITH TIME

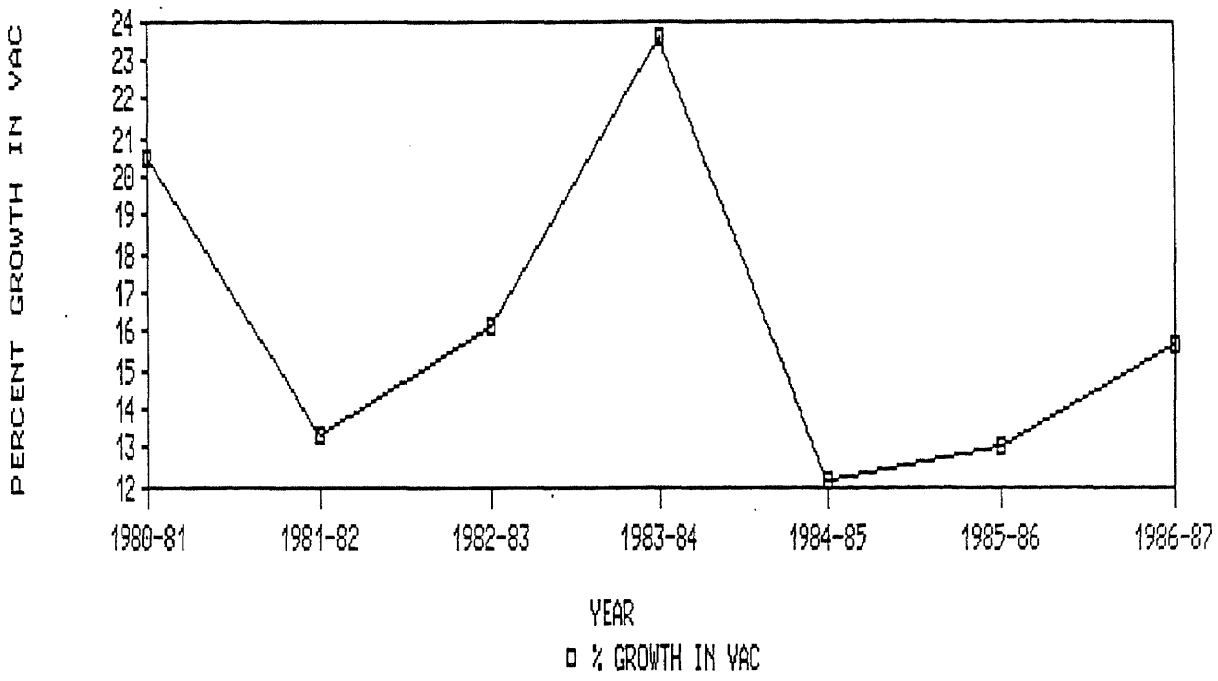


Figure 1.8a
VAC AS PERCENT OF GDP WITH TIME

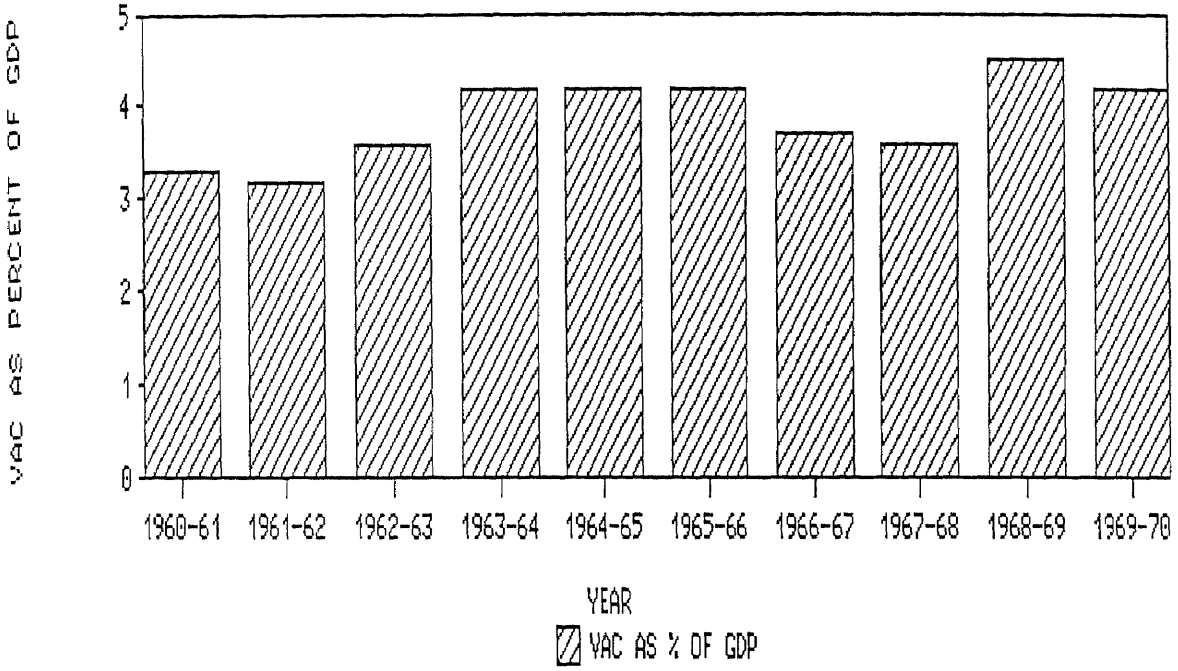


Figure 1.8b
VAC AS PERCENT OF GDP WITH TIME

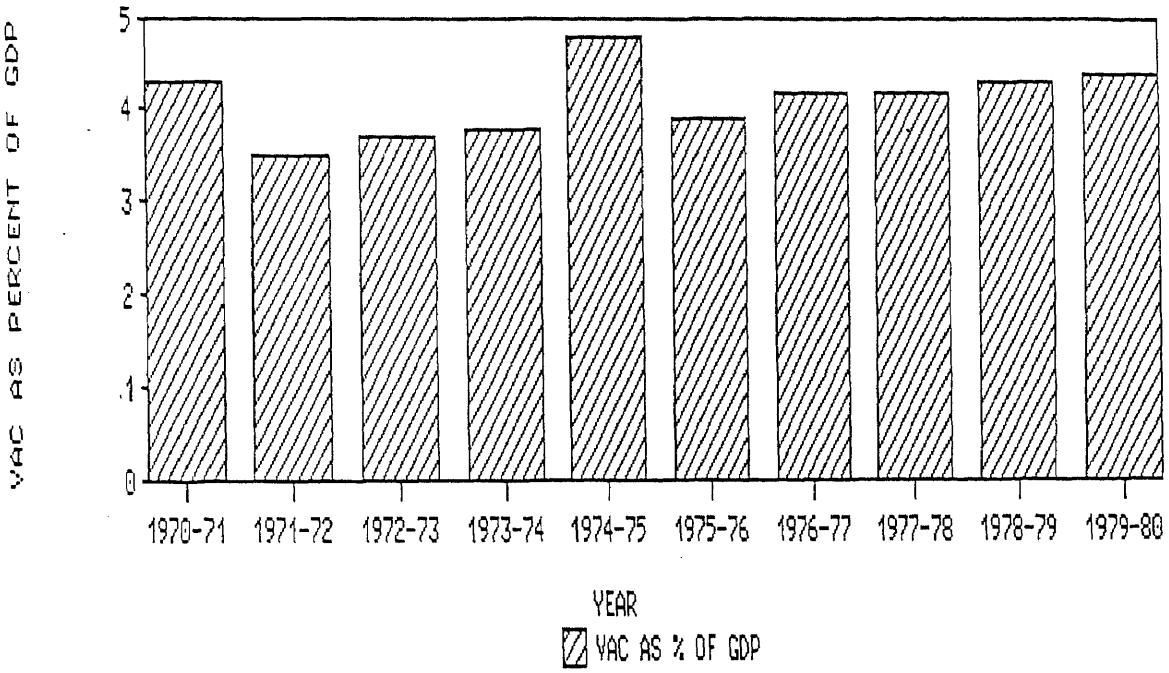


Figure 1.8c
VAC AS PERCENT OF GDP WITH TIME

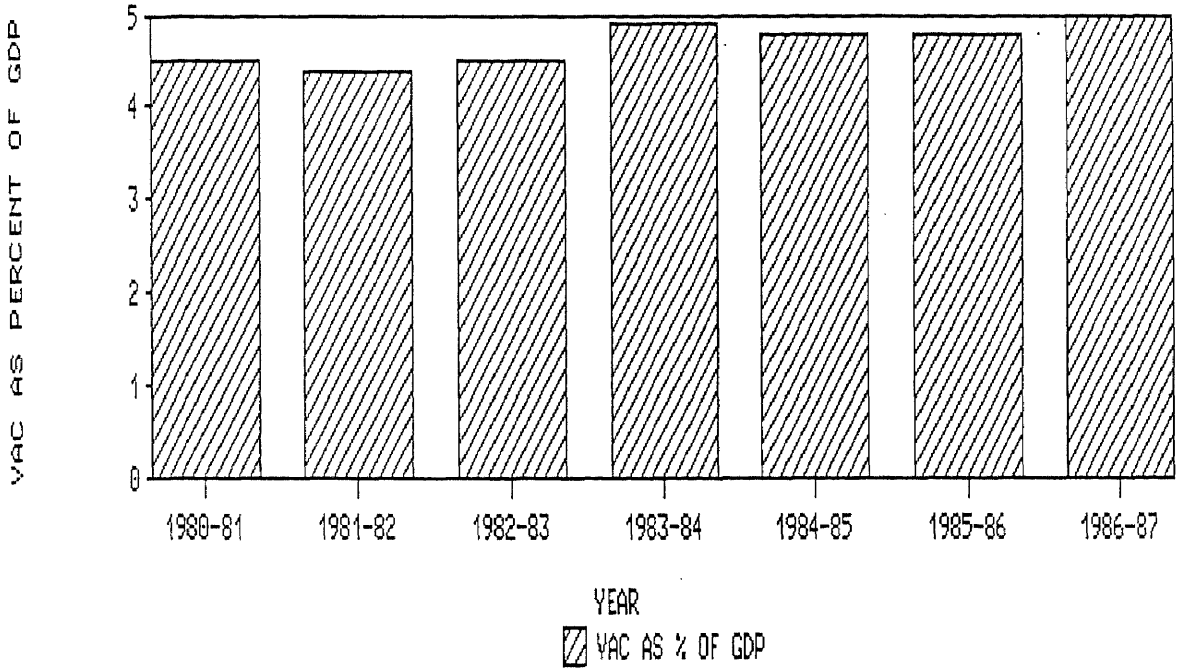


Table 1.4

GDCF/GDCF Construction in millions of Pak.Rs. (current prices)

YEAR	GDP	GDCF (T)	GDCF CONST.	GDCF (T) % of GDP	GDCF(C) % of GDCF
1963-64	22,945	5,055	2,400	22.0	47.5
1964-65	26,202	6,064	2,758	23.1	45.5
1965-66	28,969	5,507	3,040	19.0	55.2
1966-67	32,622	5,890	3,040	18.1	51.6
1967-68	35,542	5,819	3,155	16.4	54.2
1968-69	37,985	5,699	4,273	15.0	75.0
1969-70	43,347	6,835	4,555	15.8	66.6
1970-71	46,006	7,045	4,948	15.3	70.2
1971-72	49,784	6,813	4,408	13.7	64.7
1972-73	61,414	7,647	5,745	12.5	75.1
1973-74	81,690	10,614	7,785	13.0	73.3
1974-75	103,557	16,218	12,490	15.7	77.0
1975-76	119,736	24,057	16,848	20.1	70.0
1976-77	135,982	27,856	18,783	20.5	67.4
1977-78	159,925	30,505	21,685	19.1	71.1
1978-79	178,038	33,126	24,168	18.6	73.0
1979-80	210,602	41,345	29,765	19.6	72.0
1980-81	247,596	42,973	28,623	17.4	66.6
1981-82	289,834	49,174	30,618	17.0	62.3

Table 1.4 continued.....

YEAR	GDP	GDCF (T)	GDCF Const.	GDCF (T) % of GDP	GDCF (C) % of GDCF
1982-83	326,190	56,742	36,418	17.4	64.2
1983-84	372,748	63,439	48,313	17.0	76.2
1984-85	430,889	71,797	66,160	16.7	92.0
1985-86	485,210	81,319	76,053	16.8	93.5
1986-87	537,275	94,355	88,153	17.6	93.4

Refer to the following figures for details.

1.9 CONSTRUCTION AS A COMPONENT OF GROSS DOMESTIC CAPITAL FORMATION

It appears that the share of the Capital Formation in construction in the GDP increases with per capita GDP. In more than one half of the industrialized countries of the world, Gross Domestic Capital Formation in Construction is between 10 to 16% of the GDP of those countries. However, in over three fourths of the underdeveloped countries it is only between 7 to 14%. The Tables 1.1, 1.3 and 1.4 show estimates of the Gross Domestic Capital Formation in construction in Pakistan over the period of years based on 1959-60 constant and also current prices.

Figure 1.9a
COMPARISON B/W GDCF(T) AND GDCF(C)

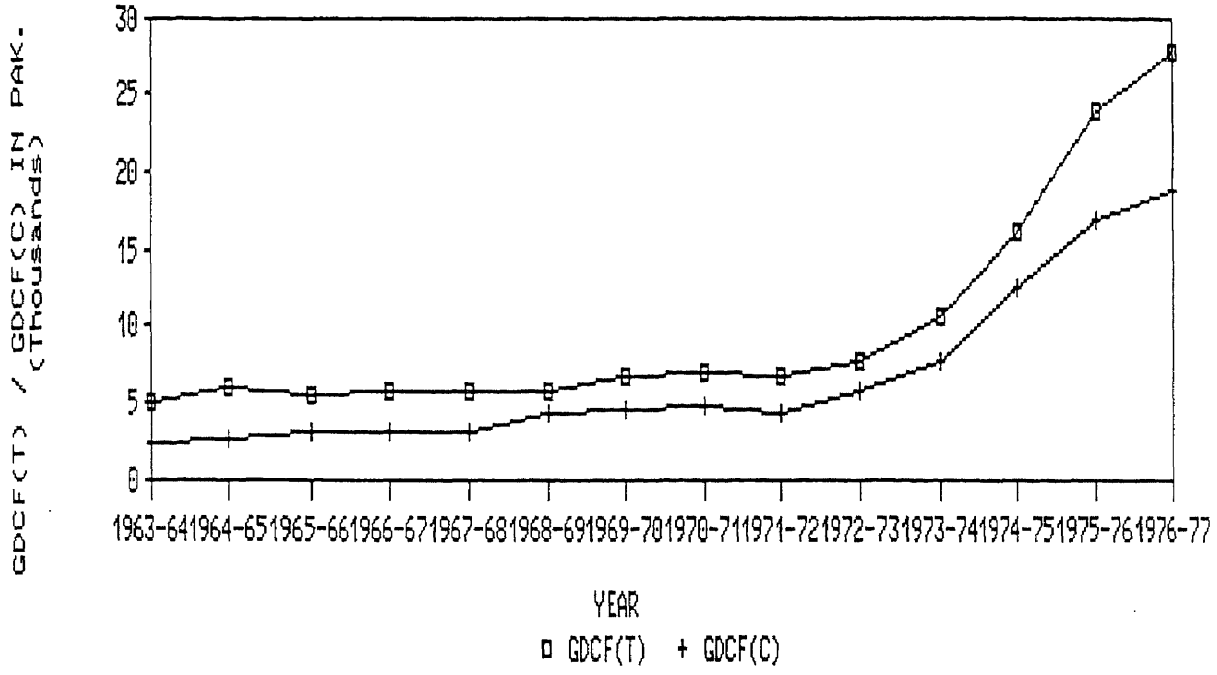


Figure 1.9b
COMPARISON B/W GDCF(T) AND GDCF(C)

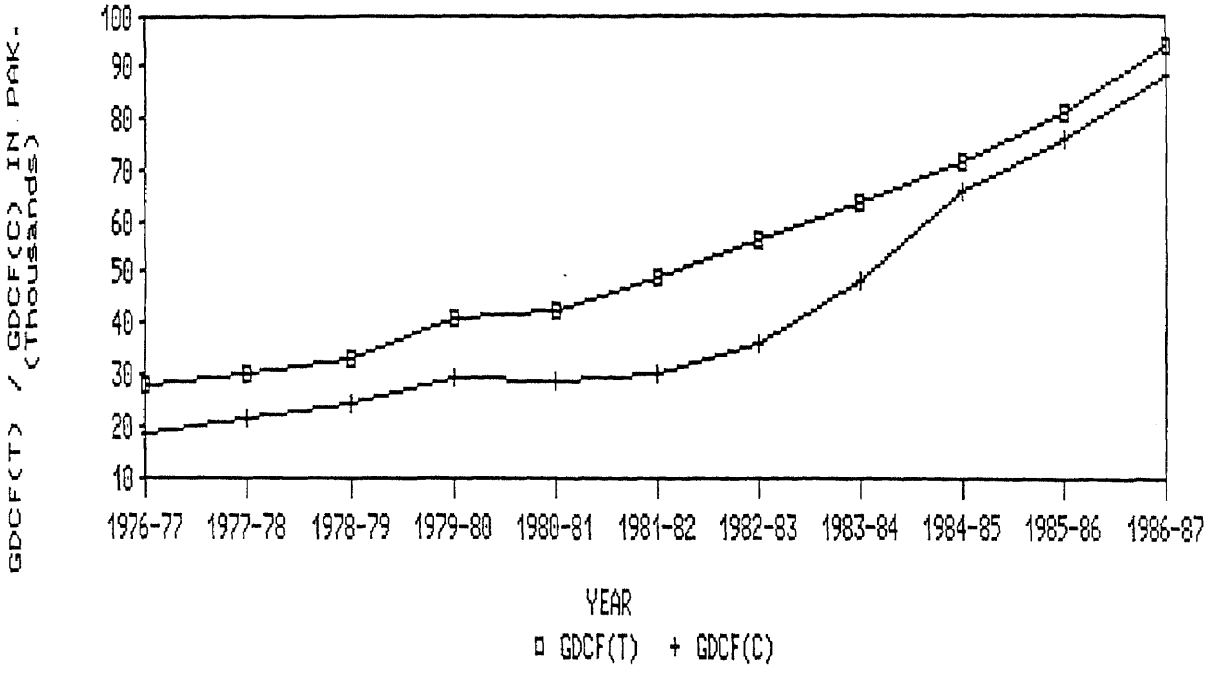


Figure 1.10a
GDCF(T) AS PERCENT OF GDP

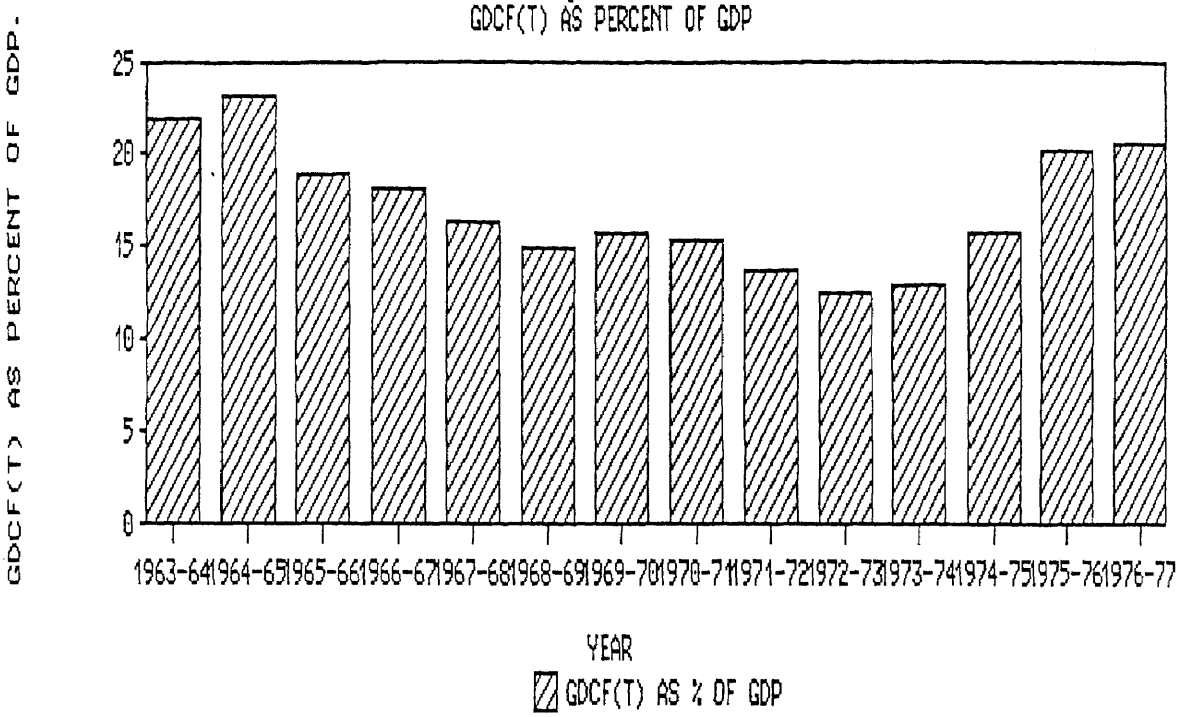


Figure 1.10b
GDCF(T) AS PERCENT OF GDP

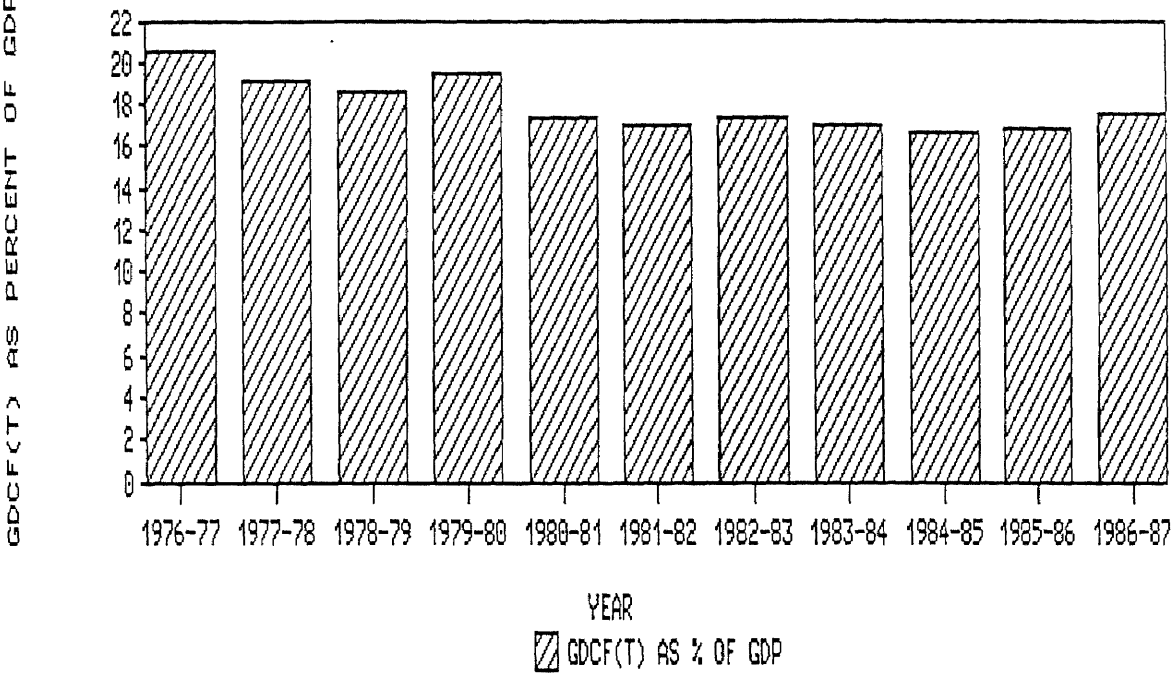


Figure 1.11a
GDCF(C) AS PERCENT OF GDCF(T)

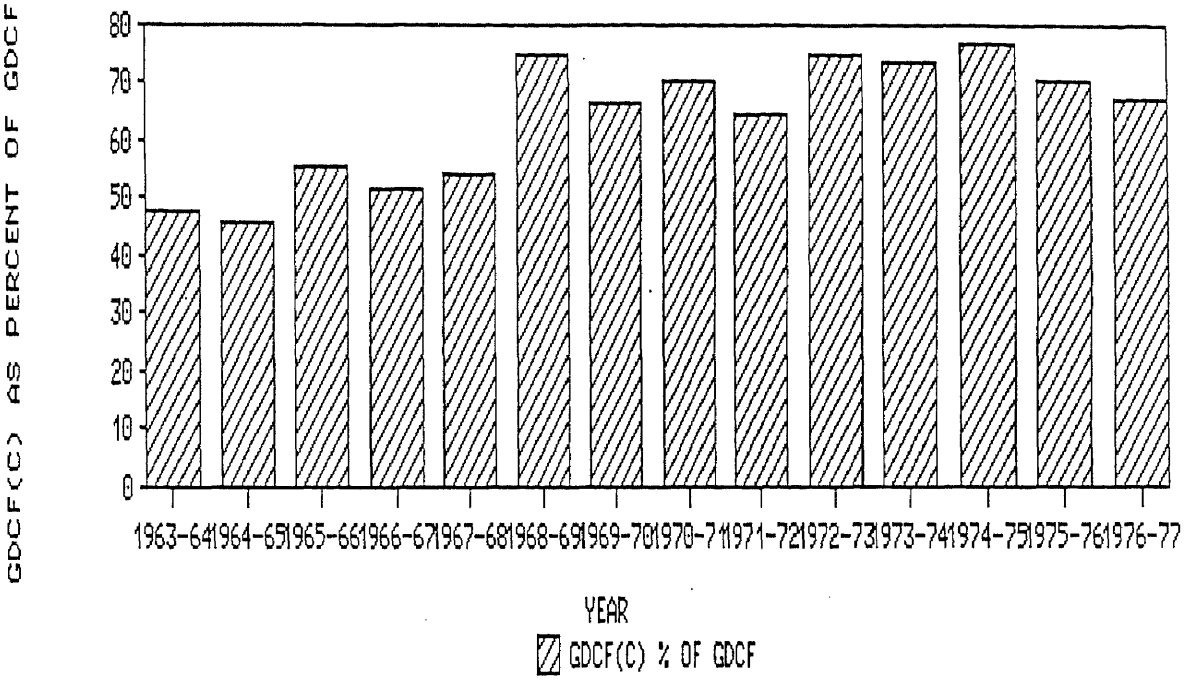
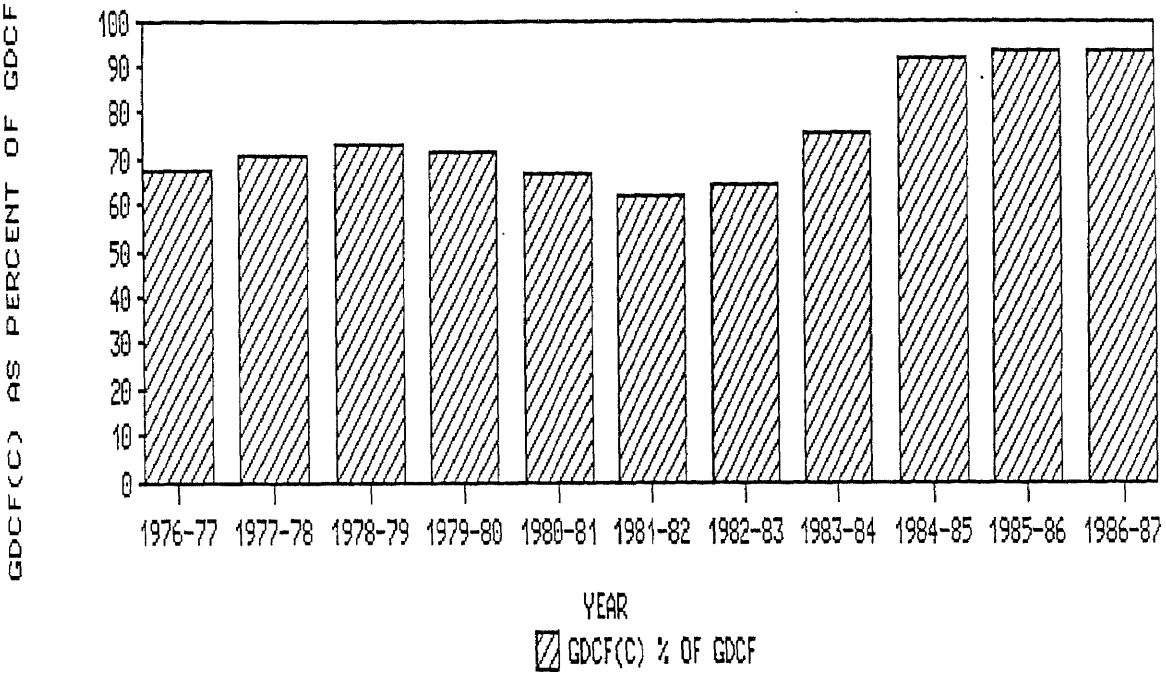


Figure 1.11b
GDCF(C) AS PERCENT OF GDCF(T)



These have been developed by assuming that Gross Domestic Capital Formation in construction in Pakistan is about two and a half times the value added in construction, that is value added in this industry is 40 percent of the total capital formation in this sector. This assumption was originally made by the working committee of the Central statistical Office of Pakistan.

The average share of the Gross Domestic Capital Formation in Construction in the Gross Domestic Product in Pakistan ranges from 6 to 15% over the period of years. This more or less falls with in the range of 7 to 14% for underdeveloped countries.

CHAPTER 2

THE DEMAND FOR CONSTRUCTION

Problems of forecasting construction

2.1 Forecasting demand for construction is dependent on the economic components of the government policy. Because of the tendency to have five year plans in most underdeveloped countries, the public sector assumes fundamental significance. The government policy therefore, exerts a profound influence on the economic development in general and construction in particular.

2.2 The construction sector's total expenditure is made up of a very large percentage of the expenditure of the Federal and Provincial government, on roads, bridges, water works, rural works etc. It is, thus, necessary to know about construction industry in future. It cannot be presumed that the government objectives, as stated in plans and documents, will be met. Analysis of the past trends and rates of growth is essential to place the issues in the proper perspective.

2.3 The Government policy is also dependent on the performance of the private sector. In the construction

industry, certain important building materials are imported from abroad. The availability and supply of these imports are dependent on the foreign exchange policy of the government, which in turn is dependent on the export policy, international loans and foreign aid. International loans and foreign aid is dependent on a whole complex of political imperatives which change with time. Although, in the short run, the most important determinant of the international loans and foreign aid is the amount secured in the last year, but from time to time, discontinuities occur and it is difficult to forecast over a long term.

2.4 It is clear that several economic and political factors, which are totally beyond the control of the construction industry, affect the demand and expenditure of the construction industry in the country.

2.5 Forecasting is also influenced by changes in the technology and the systems in construction. Theories which worked previously may not work at all or work imperfectly because of the changes in several determinants involved. Housing forecasts require consideration of owner and the rental markets separately. Impacts of changes in income, prices, availability of credit, availability of other choices etc have to be studied.

2.6 Thus a correct forecast in construction requires separate forecasts of various categories of the construction expenditures in the public and private sectors, housing, rural works program, physical infrastructure, roads etc. In turn, each forecast of these categories requires a series of statistics and estimates.

The difficulties in construction forecasting is indicated by the wide annual fluctuations in construction investment. Refer to table 2.1, 2.2 and 2.3 for the annual investment and standard deviations in the gross domestic capital formation in construction

Table 2.1

Y is in current prices in millions of Pak.Rs

Year	GDCF in construction (Y)	Y-Y"	$(Y-Y")^2$
1963-64	2,400	- 917	840889
1964-65	2,758	- 559	312481
1965-66	3,040	- 277	76729
1966-67	3,040	- 277	76729
1967-68	3,155	- 162	26244
1968-69	4,273	956	913936
1969-70	4,555	1238	1532644

Arithmetic mean $Y" = \frac{Y_1 + Y_2 + Y_3 + Y_4 + Y_5 + \ldots\ldots Y_n}{n}$

Where 'n' is the no. of observations = 7

Standard deviation^2 $= \frac{(Y_1 - Y")^2 + (Y_2 - Y")^2 + \ldots\ldots (Y_n - Y)^2}{n}$

The standard deviation in gross domestic capital formation in construction (current prices) for the period 1963-64 to 1969-70 is Pak. Rs. 735 million

Table 2.2

'Y' in current prices in millions of Pak.Rs.

Year	GDCF in construction 'Y'	Y - Y"	$(Y - Y")^2$
1970-71	4,948	- 9714.5	94371510
1971-72	4,408	- 10254.5	105154000
1972-73	5,745	- 8917.5	79521806
1973-74	7,785	- 6877.5	47300006
1974-75	12,490	- 2172.5	4719756.3
1975-76	16,848	2185.5	4776410.3
1976-77	18,783	4120.5	16978520
1977-78	21,685	7022.5	49315506
1978-79	24,168	9505.5	90354530
1979-80	29,765	15102.5	228080000

n = 10

The standard deviation in gross domestic capital formation in construction (current prices) during the period from 1970-71 to 1979-80 is Pak. Rs. 8488.7 million

Table 2.3

'Y' in current prices in millions of Pak.Rs.

Year	GDCF in construction 'Y'	Y - Y"	$(Y - Y")^2$
1980-81	28,623	- 24854	617721000
1981-82	30,618	- 22859	522533000
1982-83	36,418	- 17059	291009000
1983-84	48,313	- 5164	26666896
1984-85	66,160	12683	160858000
1985-86	76,053	22576	509675000
1986-87	88,153	34676	1202420000

n = 7

The standard deviation in the gross domestic capital formation (current prices) in construction during the period 1980-81 to 1986-87 is Pak. Rs. 21814 million.

Table 2.4

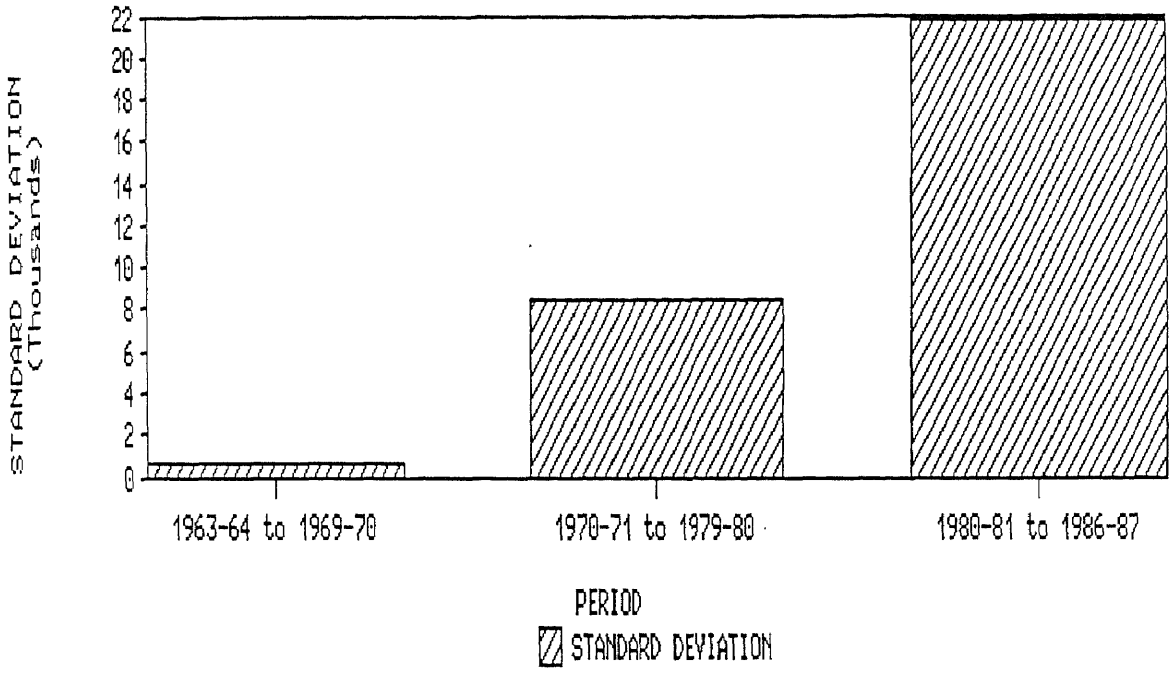
Standard deviation in current prices in millions of Pak.Rs.

Period	Standard deviation
1963-64 to 1969-70	735 million Pak.Rs.
1970-71 to 1979-80	8488.7 "
1980-81 to 1986-87	21814 "

The above table shows the wide annual fluctuations in the gross domestic capital formation in construction during various periods of time. These huge amounts indicate the difficulties involved in forecasting the value added in construction during the next 5 to 10 years.

However forecasting equations may be developed to determine the VAC 5 to 10 years. The values determined by this equation will be good to establish the trend in the VAC during the coming years. Depending upon the changes and uncertainty of various factors directly related to construction, these values may have significant variance from the actual values. They may therefore be used purely for approximate estimations.

Figure 2.1
STANDARD DEVIATION WITH TIME



2.7 Forecasting equations

We have seen in chapter 1, that the VAC is related to the Gross Domestic Product of the country. As the value of the Gross Domestic Product increased through the years, the Value Added in Construction also increased. Therefore a relation may be developed between the VAC and the GDP, which may be used to forecast the Value Added in Construction for the future. It is obvious that to determine the VAC for the coming years, the value of the Gross Domestic Product has to be estimated first, on the basis of past average percent variation (percent increase).

Another possible method could be to estimate two limits (upper and lower) of the past average percent variation in the Gross Domestic Product. This will in turn determine a set of values of VAC, which will indicate that the actual Value Added In Construction will lie between these two values.

These forecasted values of VAC are extremely important as they may be used to forecast several other items related to the construction industry, such as the demand for cement, Steel, Timber etc.

Table 2.5

Value of VAC and GDP between 1976-77 and 1986-87

in millions of Pak. Rs. (current prices)

Year	Value Added in Construction (Y)	Gross Domestic Product. (X)
1976 - 77	135,982	5,694
1977 - 78	159,925	6,642
1978 79	178,038	7,678
1979 80	210,602	9,279
1980 - 81	247,596	11.178
1981 - 82	289,834	12,679
1982 - 83	326,190	14,736
1983 - 84	372,748	18,221
1984 - 85	430,889	20,452
1985 - 86	485,210	23,136
1986 - 87	537,275	26,768

'n' no. of observations = 11.

Arithmetic mean $Y'' = (Y_1 + Y_2 + \ldots\ldots + Y_n)$ divided by (n)

$Y'' = 306753.6$

Arithmetic mean $X'' = (X_1 + X_2 + \ldots\ldots + X_n)$ divided by (n)

$X'' = 14223.9$

In this case, a straight line is to be determined that fits to the data in Table 2.5. This line should be such that it best fits the data, that is, the one that is the best moving average. Our criterion of best is the least-squares criterion. This requires that the sum of the squares of the deviations of the observed points from the straight-line moving average for the same X be a minimum. Such a 'fitted' line is called the 'regression or the forecasting line' and its equation is called the 'regression or the forecasting equation'.

The regression equation for a regression line is given by

$$Y = a + bX$$

where 'b' is called the regression coefficient and is determined as :

$$b = \frac{\text{sum of all } (X - X")(Y - Y")}{\text{sum of all } (X - X")^2}$$

$$b = 0.0519$$

and 'a' is known as the Y intercept and is determined as:

$$a = Y" - bX"$$

$$a = - 1696.6$$

Therefore, the forecasting equation is :

$$Y = - 1696.6 + 0.0519X$$

The minimum, maximum and average increases in the GDP per year between 1976-77 and 1986-87 as determined from Table 2.5 are approximately 11, 18 and 15 percent respectively. Table 2.6 shows the Gross Domestic Product for the next five years using the average, minimum and maximum increases in the Gross Domestic Product.

Table 2.6

Values of the Gross Domestic Product at current prices using the minimum, maximum and average increases in GDP in millions of Pakistan rupees.

Year	Gross domestic Product 11% increase	Gross Domestic Product 18% increase	Gross Domestic Product 15% increase
1987 - 88	596,375	633,984	617,866
1988 - 89	661,976	748,102	710,546
1989 - 90	734,794	882,760	817,128
1990 - 91	815,621	1,041,657	939,697
1991 - 92	905,340	1,229,155	1,080,652

Please refer to Figure 2.2 for the graphical representation VAC with 11, 18 and 15 percent increase in GDP.

using the minimum, maximum and average values of the GDP from Table 2.6, the corresponding values of VAC (Table 2.7) may be determined using the forecasting equation which is :

$Y = - 1696.6 + 0.0519X$

Table 2.7

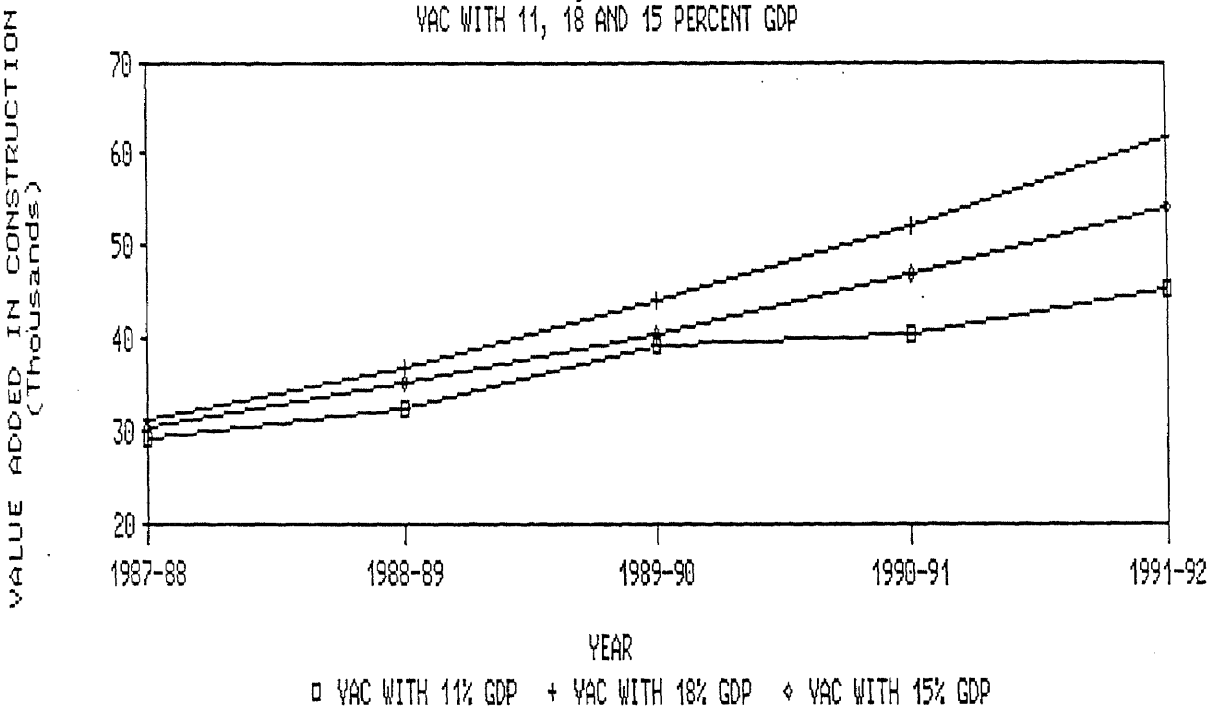
Value Added in Construction at current prices with 11, 18 and 15 percent increases in GDP.

in millions of Pak. Rs.

Year	Value Added in Construction (11% increase in GDP	Value Added in Construction (18% increase in GDP)	Value Added in Construction (15% increase in GDP)
1987 - 88	29,255	31,207	30,371
1988 - 89	32,660	37,130	35,180
1989 - 90	39,439	44,119	40,712
1990 - 91	40,634	52,365	47,074
1991 - 92	45,291	62,097	54,389

Figure 2.2 shows the curves of the expected values of the VAC between 1987-88 and 1991-92 considering the minimum, maximum and average increases in the Gross Domestic Product. It may also be concluded that the VAC during 1987-88 and 1991-92 will lie between the minimum and maximum GDP curves.

Figure 2.2
VAC WITH 11, 18 AND 15 PERCENT GDP



2.8 Another approach using the Gross Domestic Product lagged by one year may be used to determine the Value Added in Construction for the next five to ten years. The main advantage of using this system is that a direct value for VAC for the following year may be calculated without any assumption. Assumptions may however, have to be used to determine VAC for other following years. Please refer to Table 2.8 for details.

Table 2.8

Value of the Gross Domestic Product lagged by one year corresponding to the Value Added in Construction.

in millions of Pak. Rs.- current factor cost

Year	VAC	GDP lagged by one year
1977 - 78	6,642	135,982
1978 - 79	7.678	159,925
1979 - 80	9,279	178,038
1980 - 81	11,178	210,602
1981 - 82	12,679	247,596
1982 - 83	14,736	289,834
1983 - 84	18,221	326,190
1984 - 85	20,452	372,748
1985 - 86	23,136	430,889
1986 - 87	26,768	485,210

Let :

The Value Added in Construction (VAC) = Y

èThe Gross Domestic Product lagged by one year = X

Using the Table 2.8, :

Arithmetic mean Y" = 15076.9

Arithmetic mean X" = 283701.4

'b' regression coefficient = 0.0575

'a' Y intercept = - 1235.9

Therefore the forecasting equation is:

$$Y = - 1235.9 + 0.0575X$$

'X' = 537,275.

and VAC $'Y'_{1987-88}$ = Pak. Rs. 29,657 million.

2.9 The values of VAC determined by the forecasting equations will determine the future trend of the construction industry. These values are however, subject to some error or variance which inturn depends on certain factors related to the construction industry but cannot be forecasted at this time.

CHAPTER 3

QUALITY OF OUTPUT AND QUALITY CONTROL

3.1 There has not been much improvement in the actual conditions in construction during the last few years except, to some extent, in heavy engineering projects where quality control assumes significant importance. The work done by smaller contractors, particularly for various government projects, is generally inferior in quality mainly because of the corruption in the government agencies.

With regard to multi-storyed structures, there has been two known cases of collapses in the last ten years, mainly due to the use of inferior material. Both of these incidents were in the private sector. This is a recent phenomenon as there were no such reported collapses in earlier years. If quality control measures are not improved and high rise buildings continue to increase in number as commercial propositions, repetition of such incidents cannot be ruled out.

3.2 Introduction

Before mentioning the details of the quality standards of the work attained by the contractors, it is

necessary to have a look at the factors which affect the quality of work and to discuss each of them separately.

3.3 Factors affecting quality

* Realistic bidding at the time of tender through proper prequalifications/screening, etc.
* Reasonable payment to do the work.
* Reasonable time to carry out the work.
* Proper specifications, drawings and supervision by the consultants/clients.
* Adequate supply of materials.
* Sufficient number of skilled labor and competent supervisory staff.
* Adequate machinery, tools and equipment.
* Adequate number of machinery, tools and equipment with proper maintenance.
* Proper system and methods of construction.

3.4 Equitable basis of contract

Public sector construction plays an important role in all major construction activities. Therefore, to improve the quality of construction in the country, it is necessary to form construction contracts on an equitable basis.

Presently most of the contracts are one sided, giving the government agency overwhelming control. This is generally treated as a major negotiating achievement, but in most cases it promotes corruption. In order to make profits, the contractors carry out substandard work which is passed as satisfactory by the the supervisory authority. Prequalification of unqualified contractors, unfair quotations, lack of proper specifications and working drawing details, delays in decision making at various stages of construction, shortage of materials and delays in making payments are some of the reasons which are preventing the construction industry from growing at a faster pace. Each of these problems have grown to such an extent that corrective action by the government is absolutely essential to improve the efficiency of the construction industry.

3.5 Reasonable payment

Because of competition, a substantial number of contractors quote minimum rates and at times quote on the basis of doing work which is substandard, but most likely to be accepted by the consultants/clients.

For example if 100 cubic ft. of concrete specified as 1:2:4 by volume, should with optimum vibration, use approximately 17 bags (40 kilograms each) of normal portland cement, the contractors quote for this item assuming the use of 15 or at the most 16 bags. The contractors thus cut corners at the time of quoting. When tenders are called, the difference between the lowest and highest bidders is at times as great as 75%. This large difference apart from other factors does in fact, to a great extent, reflect the difference in quality of work that the contractors are offering. The work is usually awarded to the lowest bidder. In these type of cases the quality of work is inferior if the contractor has to make some profit.

The most common complaint of the contractors is the delay in payments from the clients. Delays occur mainly because decisions concerning 'Extras' are not taken in time. Since matters remain pending, construction cost goes higher causing further problems for the contractors.

The contractors who work for agencies such as Public Works Department face additional financial problems because these organizations award contracts on the basis of scheduled rates. Scheduled rates are in most cases lower than the

prevailing prices of labor and material. Contractors having no other alternative, quote on this basis and try to make profit by producing work which is below the standard specifications. Corruption is also reported in these organizations. Since scheduled rates are unrealistic and are a source of considerable malpractices, situation may be improved if the contracts are based on the bill of quantities.

3.6 To make up for the low rates the contractor adopts certain ways. These include :

a) Inspite of the fact that the contractor agrees not to claim an extra for the rise in prices (conditions of contract), the contractor still relies heavily on claiming extras during the course of contract. There are several factors which justify such claims.

b) Extras for which rates would be decided by negotiation (not by bidding).

c) Anticipating inadequate specifications.

In a way this is good, otherwise the contractor is left with no other choice but adjusting quality of work.

3.7 Thus the contractors quote low prices to get the work and make profit through substandard work, obtaining additional payment through claims and extras arising during the course of the contract.

3.8 While 'Lowest Bidding' is the best method for the award of contracts, the way it is applied under the present circumstances, reduces the effectiveness to a point that in most of the cases it would be more economical to reject the lower bids. If the bid evaluation techniques takes into account the underlying problems, improvements in the competitive bidding structure are possible. Clients/consultants should prepare their own estimates and quotations, lower estimates should be looked at with more care. If it is determined that the contractor is not able to produce the desired quality of work at the rates which he has quoted, that bid should be rejected.

3.9 Reasonable time

In most cases the time provided by the client/consultant to the contractor for completing the work is less. Therefore reasonable time should be given so that the the quality of work is not affected.

3.10 Specifications, drawings and supervision by the consultants

Consultants mention that the work should be done as per the given specifications, and in some cases quote the numbers from certain standard American or British construction specifications book. In many cases the contractors do not have sufficient knowledge and understanding about these specifications. Some may not even have a copy of the standard specifications book. This is one of the basic and common inadequacies among the contractors. Contractors perform work as per their idea of the standard practice rather than the standard specifications.

3.11 The specifications provided by the consultants in several cases is not clear. Basic details such as acceptable tolerances are missing. Improvements in specifications are required for a better output.

3.12 Detailed drawings are another factor which needs attention. In many projects, detailed drawings are either missing or improper. This was particularly noted in the government projects, where the detailed drawings were inadequate and provided the contractor very little information about the job.

3.13 The public sector construction companies also face problems, some of which are mentioned below:

* Essential information concerning the benchmarks, drawings etc. are not given in time which results in un-necessary costs for the contractor.

* The program of work framed is in many cases very unreasonable, which results in idle labor / machinery.
* Prompt measurement of work is not done.

3.14 The present system of supervision by the lower staff of the public sector agency is not suitable to meet the advanced techniques of work in which heavy equipment/machinery is used.

The public sector agencies are trying to overcome these problems. Consultants are being hired for nearly every important project and the results are satisfactory.

3.15 Materials

The quality and availability of the most commonly used materials is as follows :

1) Natural sand and gravel

These are obtained locally and are generally of good quality. In most of the cases, sieving is necessary to bring it to the required specifications, which is usually not done and results in bad concrete.

2) Stone

Mechanically crushed stone is obtained in most areas of the country. Grading, however, is not done which results in unsatisfactory concrete mix.

3) Cement

Quality of cement varies from one brand to another. For instance, in Karachi area, Zeal Pak, a public sector plant, always had a good reputation and its cement has been considered satisfactory to ensure good quality work.

There has been complaints concerning two brands (Jawedan and National) about their quality, which may have resulted from the use of inferior materials. Prior to the nationalization of the cement industries, the quality of cement was very inferior, but at present it is more or less considered to be satisfactory.

3.16 The bulk delivery methods for cement have not yet been adopted to a satisfactory extent, resulting in a longer delivery time and affecting the construction projects. Longer delivery time has affected the demand for cement and in several cases has created a black market situation.

3.17 Wood

Wood is available in wide varieties. The best quality is Deodar (also known as Dayal) which is twice as expensive as the cheapest. There seems to be no well defined specifications concerning the quality of wood and this is an area in which the architects/clients have very limited knowledge. In several cases cost becomes the only criteria. It is understandable that the contractor uses this item to make substantial amount of profit.

3.18 Steel

Mild steel reinforcement is re-rolled from billets or ingots. The quality of mild steel reinforcement bars also depends on whether it is rolled from billets or ingots. Approximately 50% of the output is produced from the scrap metal.

The quality control measures adopted at the rolling mills have been reported in several cases as unsatisfactory. In addition the certificates issued by the manufacturers through the contractors for high grade steel were sometimes found to be inaccurate as far as strength and size requirements were concerned.

3.19 Steel windows and doors

The workmanship in the manufacture of steel windows and doors is extremely poor. The sections available are not uniform and variations in sizes are well beyond the allowable tolerances required for good quality work. The reasons for this are:

a) Increase in work.

b) Immigration of skilled fabricators.

Due to the increase in demand, work is done by less experienced / skilled persons, as there is an ongoing

tendency for the more experienced to find a better paying job abroad.

3.20 Fittings for doors and windows

While still not to the international standards, the quality is generally acceptable. The quality of brass fittings with respect to workmanship is better than iron fittings.

3.21 Paints

The quality of paints manufactured locally is considered to be satisfactory provided it is used as per the manufacturer's instructions, which in many cases are not followed.

3.22 Sanitary fittings and tiles

This industry is still in the early stages of development and the fittings available are more or less sub-standard. The workmanship at present is not very good, but seems to be improving.

3.23 Pipes

Galvanized iron, cast iron, cast iron rain water, reinforced concrete and prestressed pipes are easily available. Bad jointing is one of the problems which has been reported in several cases, due to which leakages occur and the results are not satisfactory. Asbestos cement pipes, although toxic, have gained popularity because they are cheaper, but the same remarks apply to them as well. Because of toxicity, the use of asbestos should be stopped.

3.24 Electrical cables and conduits

The quality available varies considerably. Although a few brands are considered to be very good and close to international standards, most of them are sub-standard. In the absence of the specifications, the contractors use cheap and inferior material. As far as conduits are concerned, PVC pipes are gaining popularity as compared to metal as they are cheaper, rust proof and have better insulation properties. While no tests were carried out, their performance has so far been reported as satisfactory.

3.25 Staff and labor

There is a shortage of engineers, supervisory staff and skilled labor on all sites. It has been noted that generally small sized contractors (which are in large number) are not interested in employing engineers. On the other hand the engineers themselves are reluctant in joining small sized contracting firms with involvement at site and prefer to work on administrative assignments with other agencies.

3.26 Because of large scale immigration of skilled workers such as carpenters, masons, plumbers, electricians and work supervisors etc., most construction firms both large and small are forced to hire unskilled labor. After a short duration of training they are given the work of skilled labor. The result is lower productivity and higher supervision cost.

3.27 Skilled labor shortage has resulted in lower quality and quantity of output. Under these conditions, it becomes rather difficult to stress the quality control aspects of work. Another factor is the labor law, which is applicable to the construction industries. Many contractors face problems resulting from the wrong labor claims. As a

result the contractors prefer to sublet the work wherever it is possible.

3.28 Machinery

Compared to the past, there has been increased use and availability of the machines and equipment but still the number is not is not sufficient enough to meet the requirements of the construction industry and the work. Since most of the machines and equipment are imported there is always a shortage of spare parts. As a result of this, the equipment does not function at the specified output.

For example, it has been noted that in most sites, concrete vibrators were in bad condition or if in working order, were not being used properly by competent operators. Among other equipment theodolites, levels, block making machines, compactors, compressors etc., were in short supply.

3.29 Systems of working

Although most of the contracts restrict the contractors from sub-letting any part of the work without permission, basic items like excavation, concreting, shuttering, painting, flooring and wood work were in many

cases sub-let, either on 'material' basis or 'labor rate' basis.

3.30 Setting out of work

Because of the less competent supervisory staff, the small sized contractors are reluctant to use theodolites to determine the 'line' and to set up permanent control stations at certain intervals. Generally they use the triangle method which at 100 ft had shown error of approximately 1.0".

Not only the number of permanent stations at various sites was insufficient, but also their positions and heights were not proper. The columns were commonly out of line by 0.5 to 1.5 inches and out of the plumb by 0.5 " at a height of 10'. The more laborious and less accurate water-in-plastic-pipe method is still being used at various sites to determine the level instead of dumpy or quick set level.

3.31 Concreting and Plastering

The following was noted in the above mentioned works at site:

* Sieving of the aggregates is not done properly.
* The water cement ratio is not controlled.
* Mixing of the aggregates is not done properly and and the contractor does not have good knowledge concerning the mixing time.
* Concrete vibration is not done properly because most of the operators are incompetent.
* The general form work needs to be improved. In many cases the form work was not in line, level or plumb.
* Concrete curing needs attention. The curing time is usually less than required.
* The general workmanship (plastering) particularly at edges and joints needs improvement.

* The laboratory tests for concrete do not represent the mix at site. The values of the strength determined in the laboratory are usually higher than the actual strength.

3.32 Block masonry

The following is to be noted concerning block masonry:

* In most of the cases the blocks are made by hand and the mixing of materials is not proper.
* The water-cement ratio is not controlled.
* Improper amount of cement used, usually less.
* Improper size of aggregates, due to inadequate sieving.
* Improper curing due to lesser amount of time.
* Improper water content in the mortar used for the masonry.

3.33 Brick masonry

The remarks for block masonry apply in general to brick masonry as well. While the individual skills for brick masonry are higher, the availability of bricks with regard to price and quality remains a problem. In many cases burning of the bricks was noted to be unsatisfactory. One of the major problems faced by the brick industry is the selection of clay.

3.34 Painting

* The surfaces to be painted were not prepared properly.
* In most of the cases paint was found to be diluted to a greater degree than specified by the manufacturer.

3.35 Wood work

The demand as well as prices for timber has increased sharply during the last decade and unless the imports are increased, the problem would deteriorate. While lack of seasoning facilities remain in the country, the carpentry skills are satisfactory.

3.36 Conclusion

* Pre-qualifications of the contractors should be improved. Only the qualified should be pre-qualified.
* It must be ensured that the bidders are quoting for approximately the same quality of work and that they will obtain reasonable profit.
* The contractors should be given reasonable time to complete the project.

* Specifications, Drawings and Supervision should be improved to ensure better output and quality of work.
* Training of manpower should be improved.
* The availability of machinery, equipment and spare parts should be improved.
* Scheduled rates should be replaced by the bill of quantities.
* Compulsory involvement of consultants for major works in the public and private sectors.

CHAPTER 4

IMPORTANT BUILDING MATERIALS

4.1 The cement industry

Table 4.1

No. of units and their output during various years

Year	No. of units	Output in 'thousands' of tons	Installed capacity in 'thou-sands' of tons	Percent capacity utilized	Percent growth in output
1971	9	2702	3450	78.3	---
1972	9	2606	3450	75.3	- 3.6
1973	9	2878	3450	83.4	+10.4
1974	9	3145	3450	91.2	+ 9.3
1975	9	3320	3450	96.2	+ 5.6
1976	9	3196	3450	92.6	- 3.7
1977	9	3071	3450	89.6	- 3.9
1978	9	3224	3450	93.4	+ 5.0
1979	9	3023	3450	87.6	- 6.2
1980	9	3343	3450	96.9	+10.6

Table 4.1 continued.....

Year	No. of units	Output in 'thousands' of tons	Installed in 'thousands' tons	Percent capacity utilized	Percent growth in output
1981	9	3538	--	--	+ 5.8
1982	9	3657	--	--	+ 3.4
1983	11	3938	--	--	+ 7.7
1984	13	4503	--	--	+14.3
1985	13	4698	--	--	+ 4.3
1986	14	4980	7510	66.3	+ 6.0
1987	14	3969	7510	52.8	-20.3

Refer to figures 4.1 and 4.2 for graphical representation of Table 4.1

It may be noted that cement has never been produced at the the installed capacity. The only years when the maximum capacity was utilized were 1975 and 1980 when the production was 96.2% and 96.9% respectively of the installed capacity. Particularly in the years 1986 and 1987 the percent utilization fell as low as 66.3 and 52.8. This implicates a need for proper investigation and immediate action to rectify the situation.

Figure 4.1
ANNUAL OUTPUT OF CEMENT IN PAKISTAN

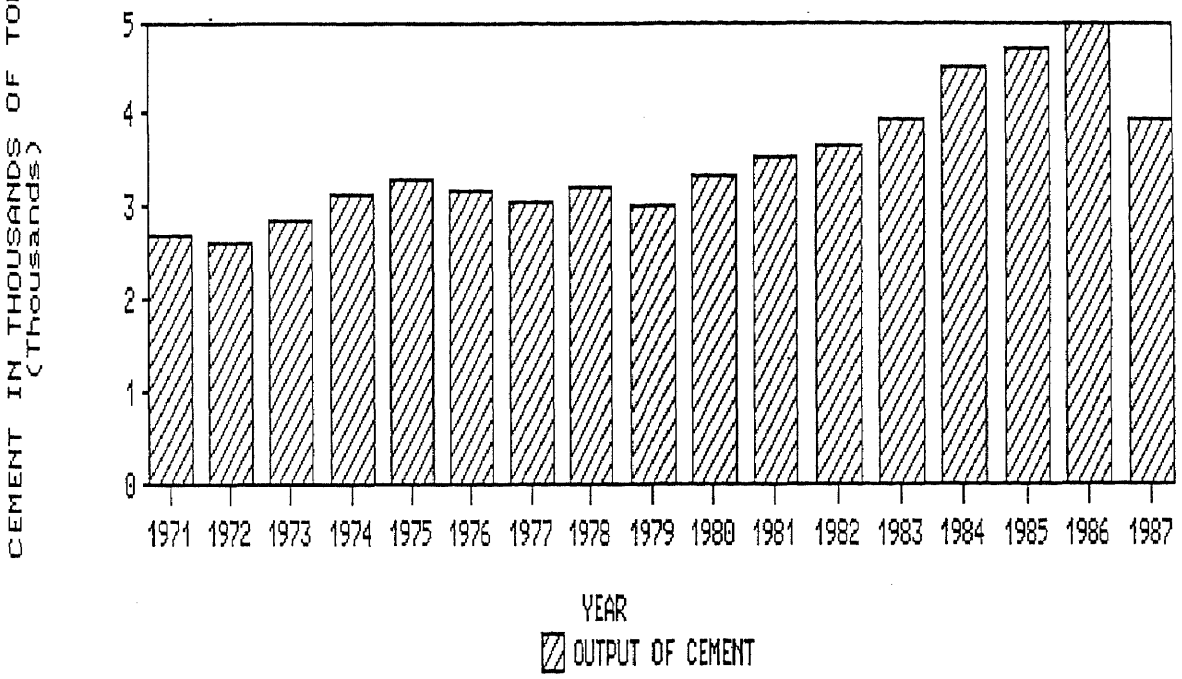
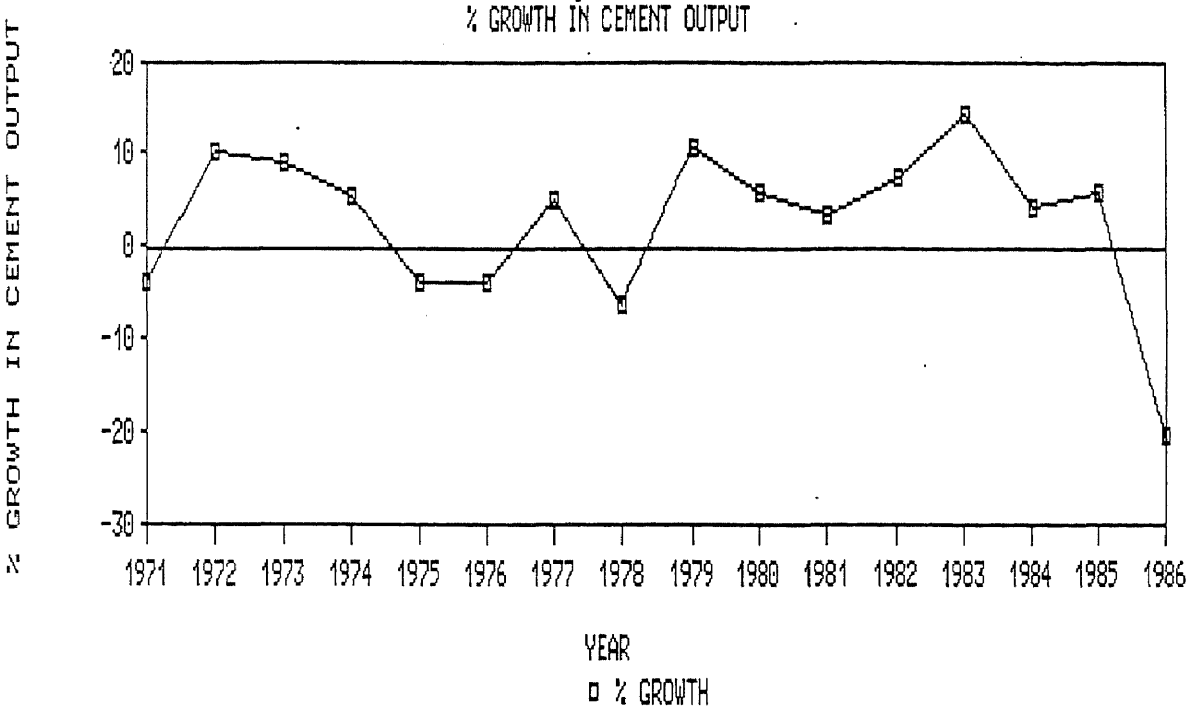


Figure 4.2
% GROWTH IN CEMENT OUTPUT



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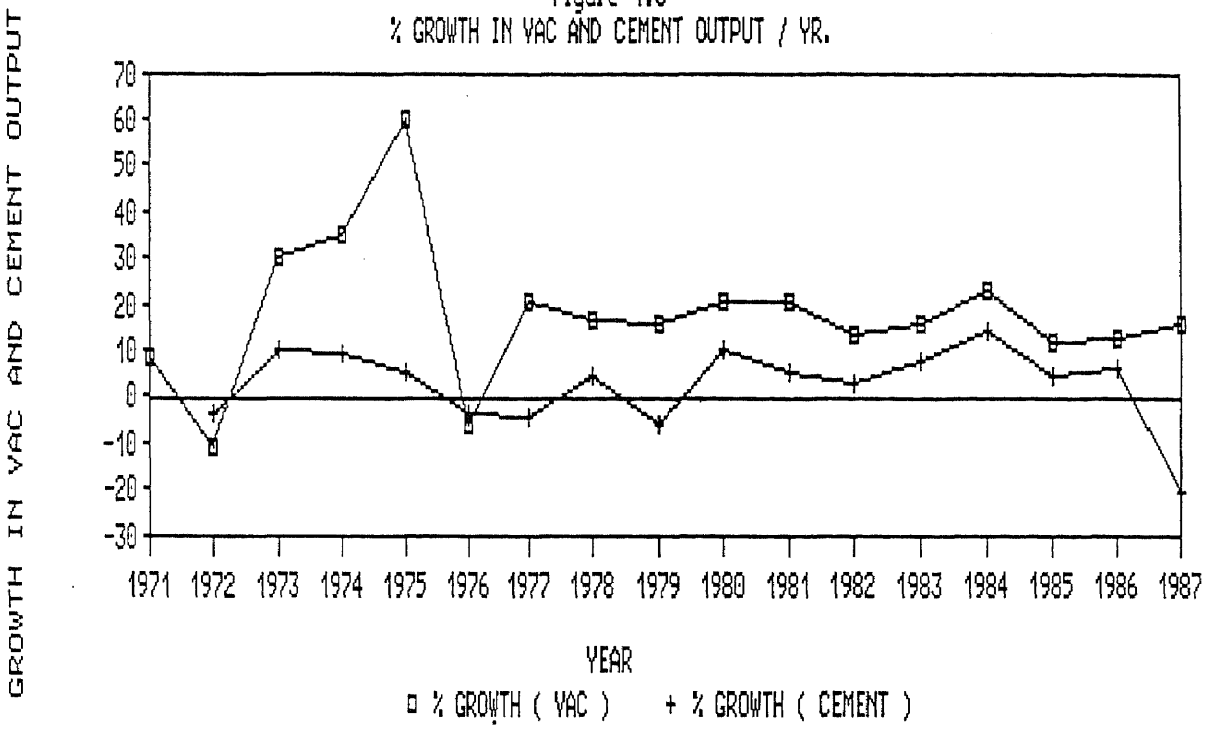
1977	9	3071	3450	89.6	- 3.9
1978	9	3224	3450	93.4	+ 5.0
1979	9	3023	3450	87.6	- 6.2
1980	9	3343	3450	96.9	+10.6

It can be clearly seen that the cement production was not consistent with the Value Added in Construction. During 1973 and 1974, increase in the VAC was 30.3 and 35.5 percent respectively, where as the corresponding increase in the cement production was only 10.4 and 9.3 percent. In 1975, the increase in VAC was 60.4 percent and the corresponding increase in the cement production was only 5.6 percent.
In the last year, ie 1987, the growth in the VAC was 15.7 percent compared to 1986, where as the cement production fell by -20.3 percent.
It is obvious that the balance of cement requirement was fulfilled through imports. The cement industry in the country thus needs attention and there is a huge potential for its expansion.

Please refer to the figure 4.3 for details.

Figure 4.3
% GROWTH IN VAC AND CEMENT OUTPUT / YR.



4.2 Factors responsible for the rise in demand

Demand for the cement has risen at a very sharp pace mainly because of the increase in the construction activity. (Refer to Table 4.2.)
Some of the other factors are as follows:

* Sudden and huge requirement of the cement for the repair of Tarbela dam.
* Sharp increase in steel prices with the result that designers tried to substitute cement for steel as far as possible.

4.3 Supply problems

The supply of cement has never been able to keep up with the demand. Following are some of the main reasons:

* Inefficient delivery and transportation system.
* Several serious reported damages and breakdowns resulting from natural causes such as heavy rainfall and floods.
* Lower annual production due to various factors such as shortage of lime stone etc.

There had always been complaints that the consumers do not receive cement at the right price and in the required quantities. To solve this the State cement corporation took various measures to streamline the supply and distribution of cement in the country. This included fixation of quotas for the federal, provincial and private sector. The corporation had also set-up 28 fair price shops in the country to ensure that the consumers get the cement at the official prices. The number of the fair price shops was so small that it did not change the situation to deliver the cement at controlled prices. At this time the cement is supplied directly to:

* The government departments for their own use.
* The fair price shops.
* The whole sale dealers.

Several malpractices were reported among the whole sale dealers, who sold their permits to other dealers at high rates, who, in turn, released the stocks to the contractors and small consumers at their self determined prices. There have been several occasions when artificial shortage was created by the dealers simply by not releasing the cement. This results in false high demand and the dealers to charge unfair high prices.

4.4 Demand projections for cement

Taking into consideration the past pattern in the growth in the VAC, it is reasonable to assume 20 percent increase in VAC annually for the next five years. Therefore, the future demand and production pattern of cement for the next five years can be determined.

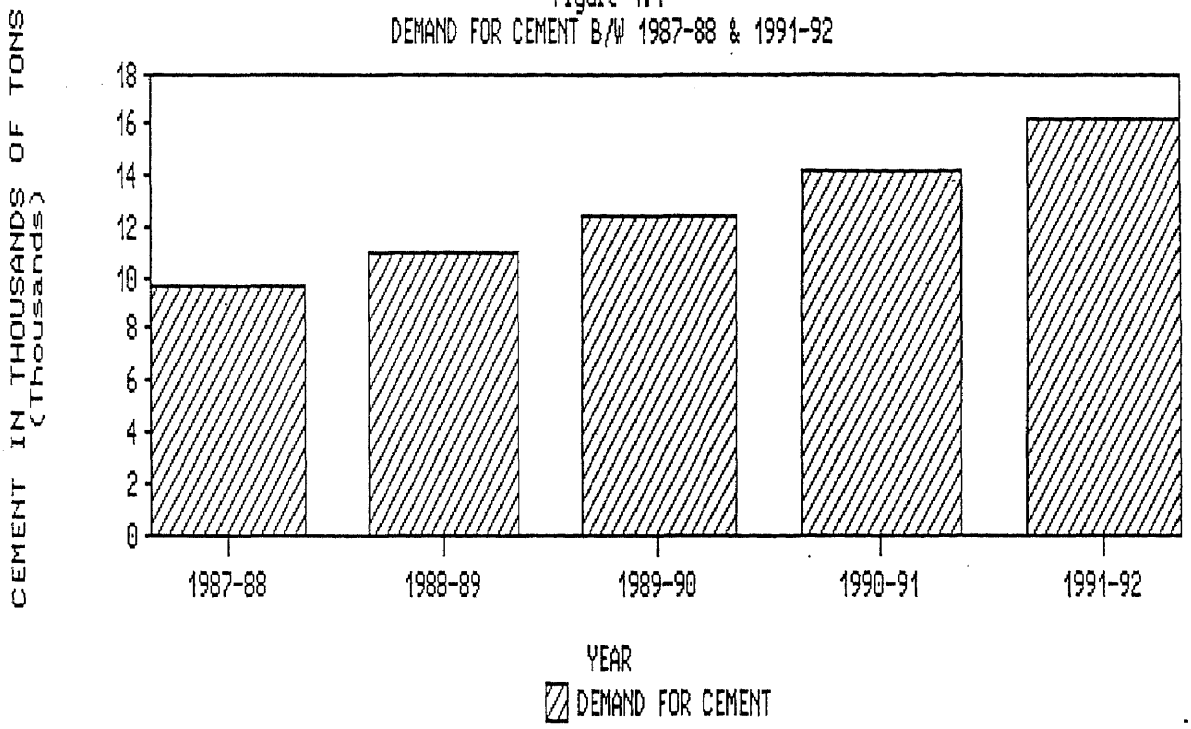
Table 4.3

Expected demand for cement between 1987-88 and 1991-92

Year	Expected VAC in million of Pak. Rupees	Demand for cement in 'thousands 'of tons.
1987-88	30,371	9754
1988-89	35,180	11047
1989-90	40,712	12536
1990-91	47,074	14247
1991-92	54,389	16215

For expected values of VAC, please refer to chapter 2. Figure 4.4 shows the demand of cement in the next five years.

Figure 4.4
DEMAND FOR CEMENT B/W 1987-88 & 1991-92



The following equation is developed and used to determine the demand for cement in tons over the next four years :

$$Y = 1584 + 0.269X$$

Where as,

X = Value Added in Construction (current prices)

Y = Demand of cement in thousand tons

Arithmetic mean for VAC X" = 4634.5

Arithmetic mean for the demand for cement in thousand tons Y" = 2830.75

4.5 Conclusion

If the present production pattern continues, shortage of cement can be forcasted in the next five years. Efforts should be made to increase the production of the existing plants as they are operating at lower than their installed capacity. Addition of one or two plants may be another solution to this problem.

4.6 Iron and Steel

There are 150 registered units in the country which manufacture iron and steel products. Out of the 150 units 115 manufacture rolled steel products used by the construction industry. Details of the production and demand between 1980-81 and 1986-87 are shown in Table 4.4.

Table 4.4

Production, Growth and demand for iron and steel

Year	Production in 'thousand' tons	Percent increase in production	Demand in 'thousand' tons
1980 - 81	494.7	+ 17.5%	660.3
1981 - 82	550.8	+ 11.3%	662.2
1982 - 83	636.7	+ 15.6%	702.3
1983 - 84	654.2	+ 2.8%	738.0
1984 - 85	718.5	+ 9.8%	849.4
1985 - 86	731.7	+ 1.8%	891.5
1986 - 87	582.0	- 20.0%	951.6

Please refer to Figures 4.5 and 4.6 for the graphical representation of table 4.4.

Figure 4.5
PRODUCTION/DEMAND FOR IRON & STEEL

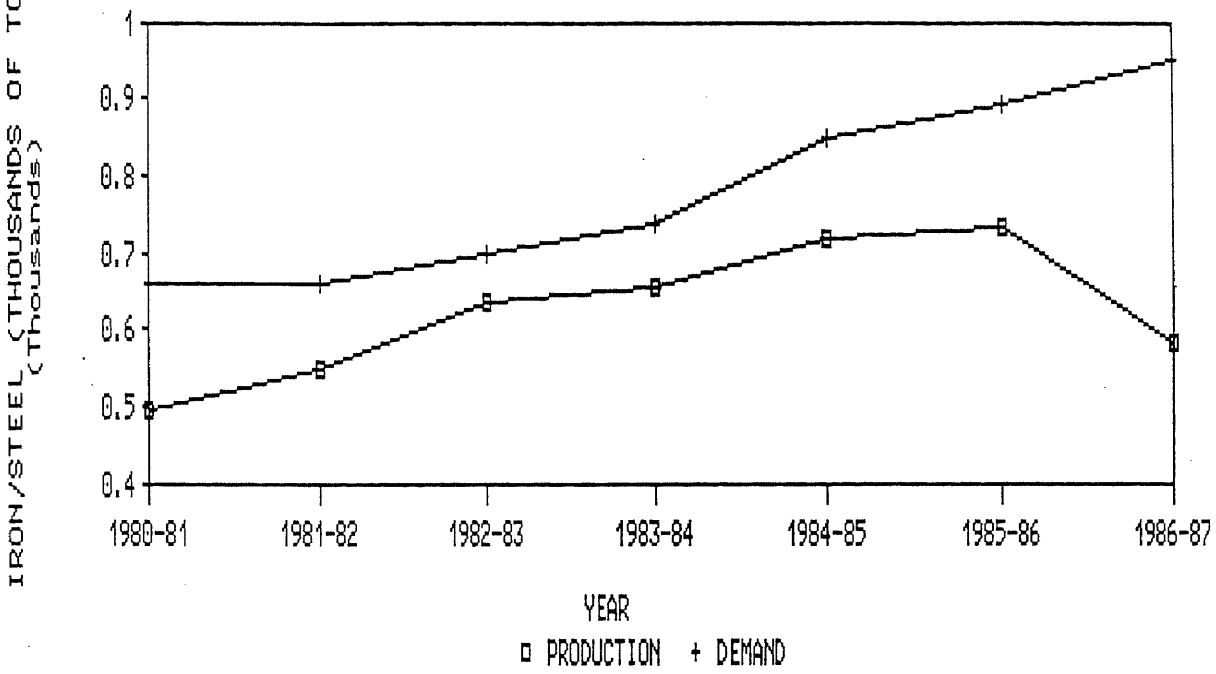


Figure 4.6
INCREASE IN % PRODUCTION OF IRON/STEEL

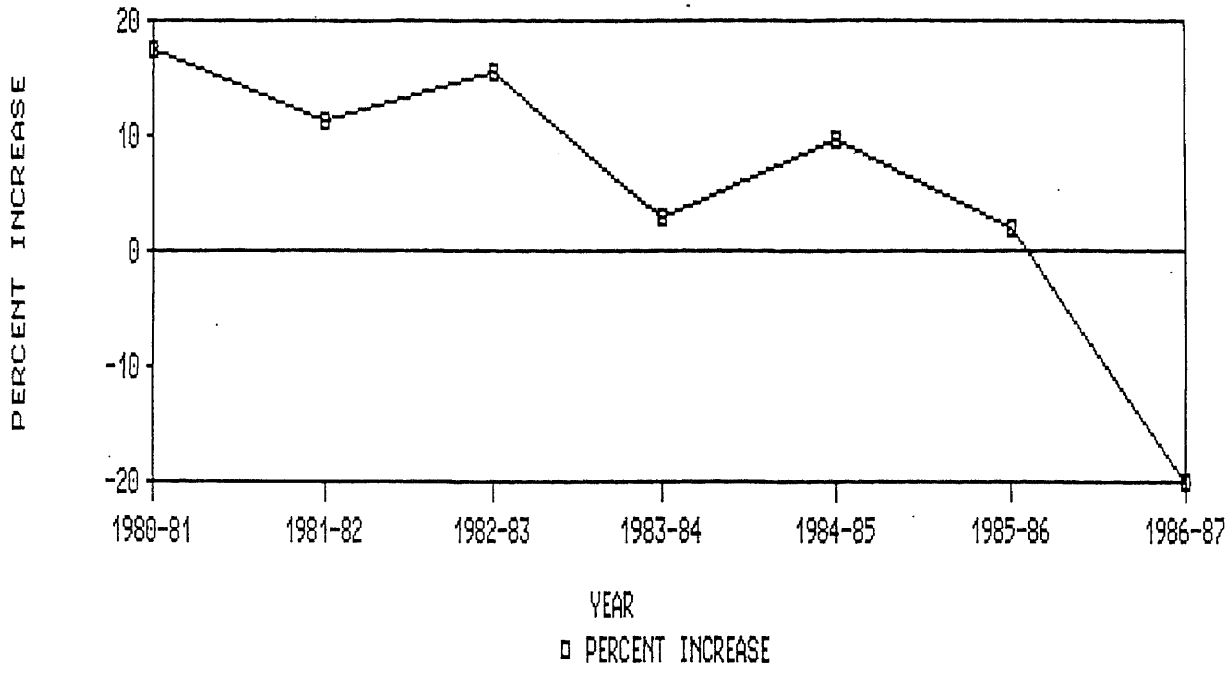


Table 4.5 shows the expected demand for iron and steel during the next four years.

Table 4.5

Demand for iron and steel during the period 1987-88 and 1991-92

Year	Demand in 'thousand' tons
1987 - 88	890.9
1988 - 89	950.7
1989 - 90	1,019.5
1990 - 91	1,098.5
1991 - 92	1,189.7

Please refer to Figure 4.7 for the graphical representation of Table 4.5.

Expected demand for iron & steel during 1987-88 to 1991 - 92 is determined using the following forecasting equation:

$$Y = 513.1 + 0.01244X$$

Where

X = Value Added in Construction (current value)

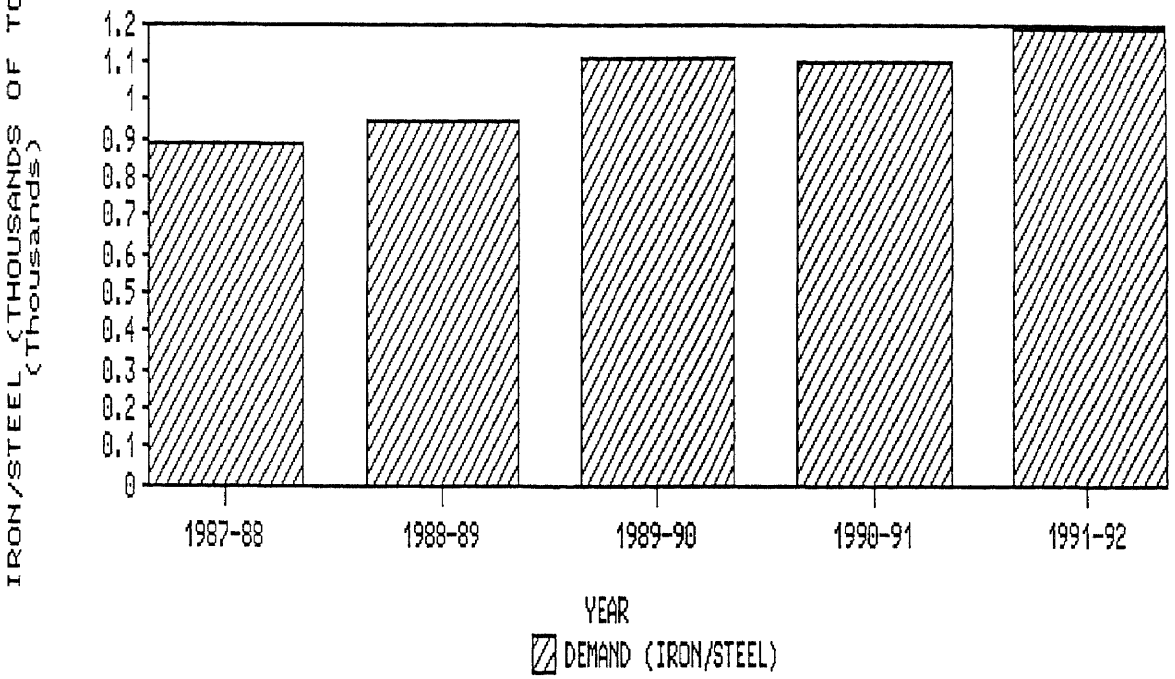
Y = Demand for iron and steel in thousand tons

Arithmetic mean X" = 16810.4

Arithmetic mean Y" = 722.2

Y intercept 'a' for regression line = 513.1

Figure 4.7
DEMAND FOR IRON/STEEL



According to the Tables 4.4 and 4.5, the rate of growth in the production of iron and steel between 1980-81 and 1982-83 was 14.8 percent, between 1983-84 and 1985-86, was 4.8 percent and finally during 1986-87 the production fell by 20.0 percent.

It is obvious that during the last decade, huge imports were made to meet the demand requirements of the construction industry. If the production rate for iron and steel follows the same pattern in the future years, serious problems may be anticipated. Therefore installation of additional plants and improvement of the existing units is extremely necessary.

4.7 Timber

The forest resources are quite inadequate to meet the national needs. The country has a land mass of about 80 million hectares, of which only 4.5 percent is under forests. Of the forests, only 40 percent is exploitable while the rest is maintained for the protection of soil and conservation of water

At present, government controlled forests produce approximately 300,000 cubic meters of timber and 400,000 cubic meters of firewood annually, while the estimated annual demand is 1.9 million cubic meters of timber and 16.7 million cubic meters of firewood. This gap is met mainly from imports of wood and wood products worth approximately Pak. Rs. 1.7 billion per annum.

It is obvious that the demand for timber is approximately 6.5 times the annual production of timber. The following table (Table 4.6) shows the annual production of timber against total annual forest production. In the absence of the exact data (of annual timber production), the annual timber production is estimated with the assumption that it is approximately 43 percent of the total forest production.

Table 4.6

Annual forest production and annual timber production during the years 1980-81 and 1986-87

Year	Annual forest production in thousand cubic meters	Annual timber production in thousand cu. meters
1980 - 81	628	270
1981 - 82	693	298
1982 - 83	686	295
1983 - 84	724	311
1984 - 85	769	331
1985 - 86	699	301
1986 - 87	733	315

Figure 4.8 shows the graphical representation of Table 4.6.

Figure 4.8
ANNUAL FOREST / TIMBER PRODUCTION

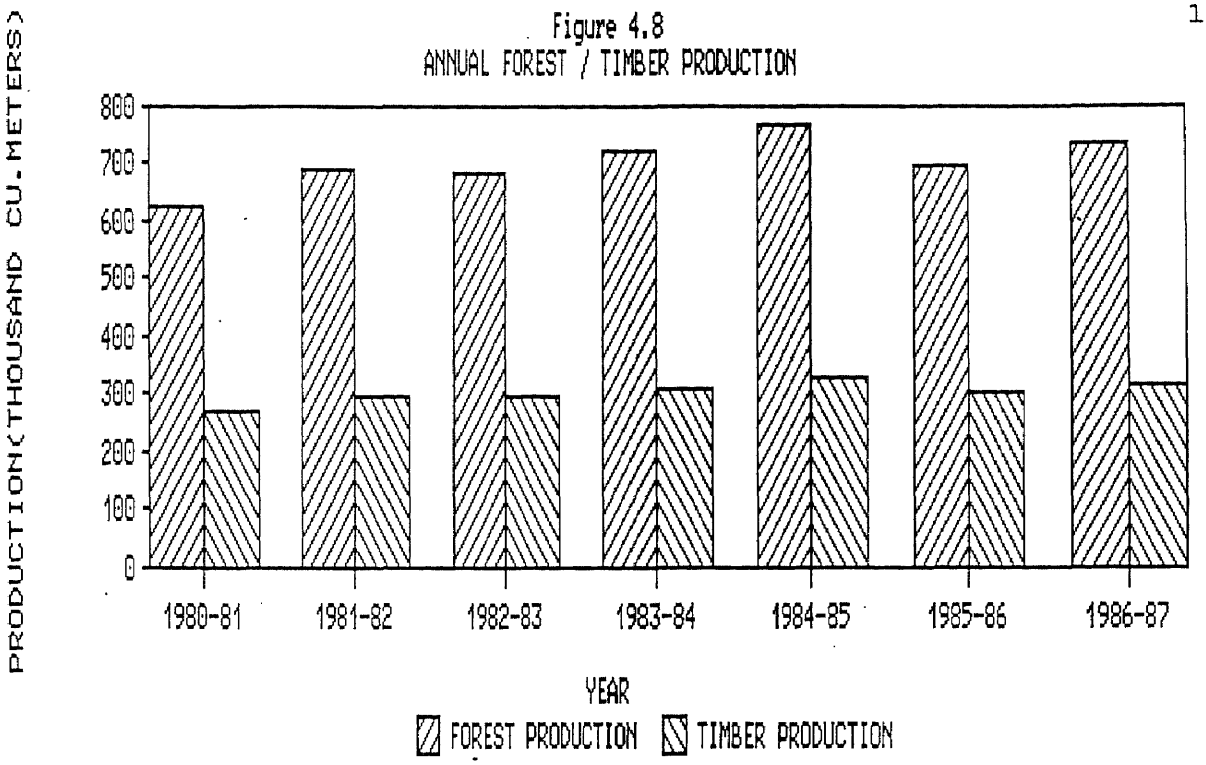


Table 4.7

Percent growth in the annual forest and timber production during the years 1980-81 to 1986-87

Year	Percent growth in the annual timber production
1980 - 81	----
1981 - 82	+ 10.3
1982 - 83	- 1.0
1983 - 84	+ 5.5
1984 - 85	+ 6.2
1985 - 86	- 9.0
1986 - 87	+ 4.9

Figure 4.9 shows the graphical representation of Table 4.7.

The average growth per year (timber production), between the years 1980-81 and 1986-87 is 2.8 percent.

The following table (Table 4.8) shows the demand for timber during the next five years assuming 5 and 10 percent increase in the demand per year.

Figure 4.9
% GROWTH IN ANNUAL TIMBER PRODUCTION

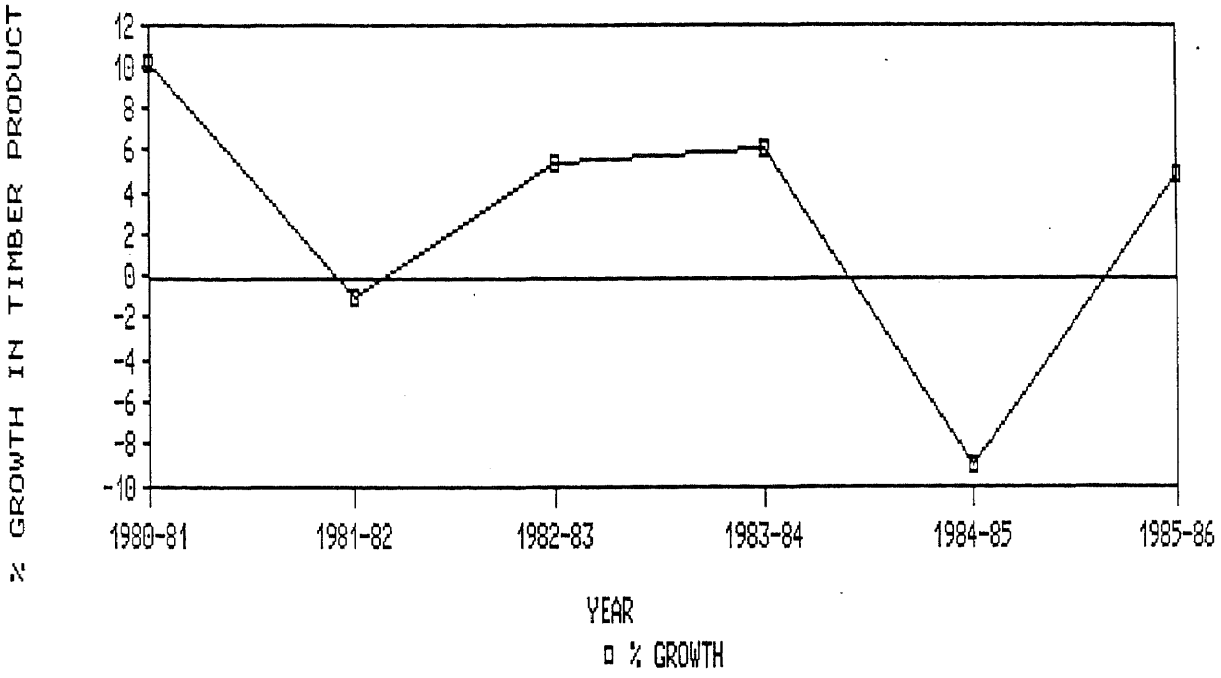


Table 4.8

Demand for timber between the years 1987 - 88 and 1991 - 92

Year	Demand for timber in million cubic meters (5% rate of growth)	Demand for timber in million cubic meters (10% rate of growth)
1987 - 88	1.995	2.090
1988 - 89	2.095	2.299
1989 - 90	2.200	2.523
1990 - 91	2.310	2.775
1991 - 92	2.426	3.053

The following table (Table 4.9) shows the annual production of timber during the next five years assuming a growth rate of 2.8 percent

Table 4.9

Annual production of timber between the years 1987 - 88 and 1991 - 92 in million cubic meters.

Year	Annual production of timber
1987 - 88	0.308
1988 - 89	0.317
1989 - 90	0.326
1990 - 91	0.335
1991 - 92	0.344

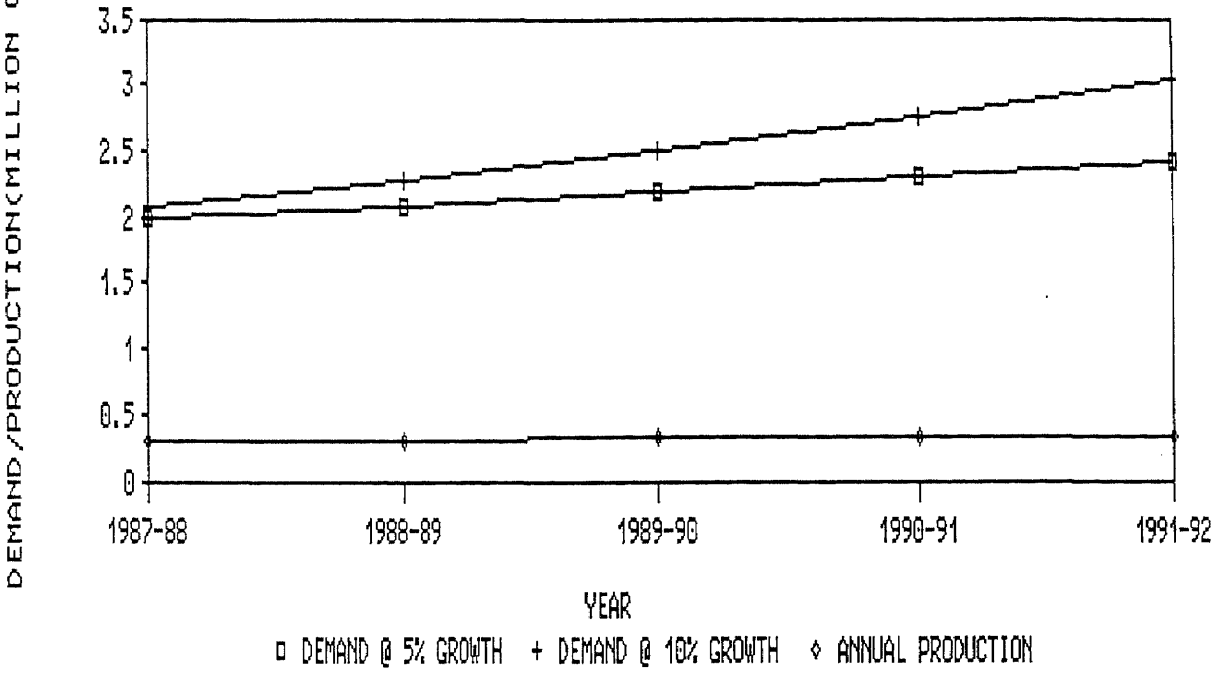
please refer to the Figure 4.10 for the graphical representation of Tables 4.8 and 4.9. From the figure it is obvious that huge imports are required during 1987-88 and 1991-92 to meet the timber requirements.

There is no immediate solution to this problem, however following suggestions may prove useful in later years.

* Concerted efforts to increase the forest area.
* Planting on waste lands in high rainfall areas.
* Raising and extension of nurseries.
* Introducing plantation campaigns.

Please refer to chapter 3 for discussion on other building materials.

Figure 4.10
DEMAND AND PRODUCTION OF TIMBER



CHAPTER 5

COST AND PRICE TRENDS

5.1 General Trends

To a large extent, the recent price rises in the construction industry are a reflection of the general rise in the prices of consumer and industrial goods in the country. Prices, especially of steel and cement, have risen all over the country because of the acute shortages of supply resulting from demand pressures for new construction. Other material inputs have followed a similar trend.

Labor costs have also risen sharply, partly due to the shortages created in the supply of skilled labor resulting from increased rate of migration to the middle east and other countries which offer higher salaries and benefits and partly due to the general increase in the wages throughout the country. Behavior of increase in labor force with an increase in the value added in construction is discussed in the next chapter.

5.2 The following table (Table 5.1) provides an index of wholesale prices of general building materials and shows

the price trends for the main inputs in the construction industry.

Table 5.1

Index of wholesale price of building materials in the construction industry.

Year	Building materials
1975 - 76	100.00
1976 - 77	114.31
1977 - 78	122.88
1978 - 79	130.38
1979 - 80	143.06
1980 - 81	165.23
1981 - 82	187.03
1982 - 83	194.00
1983 - 84	213.14
1984 - 85	228.20
1985 - 86	232.11
1986 - 87	238.04

The above table (Table 5.1) and the following figure (Figure 5.1) show the price trends of general construction materials between 1975-76 and 1986-87.

Figure 5.1
INDEX OF PRICES OF BUILDING MATERIALS.

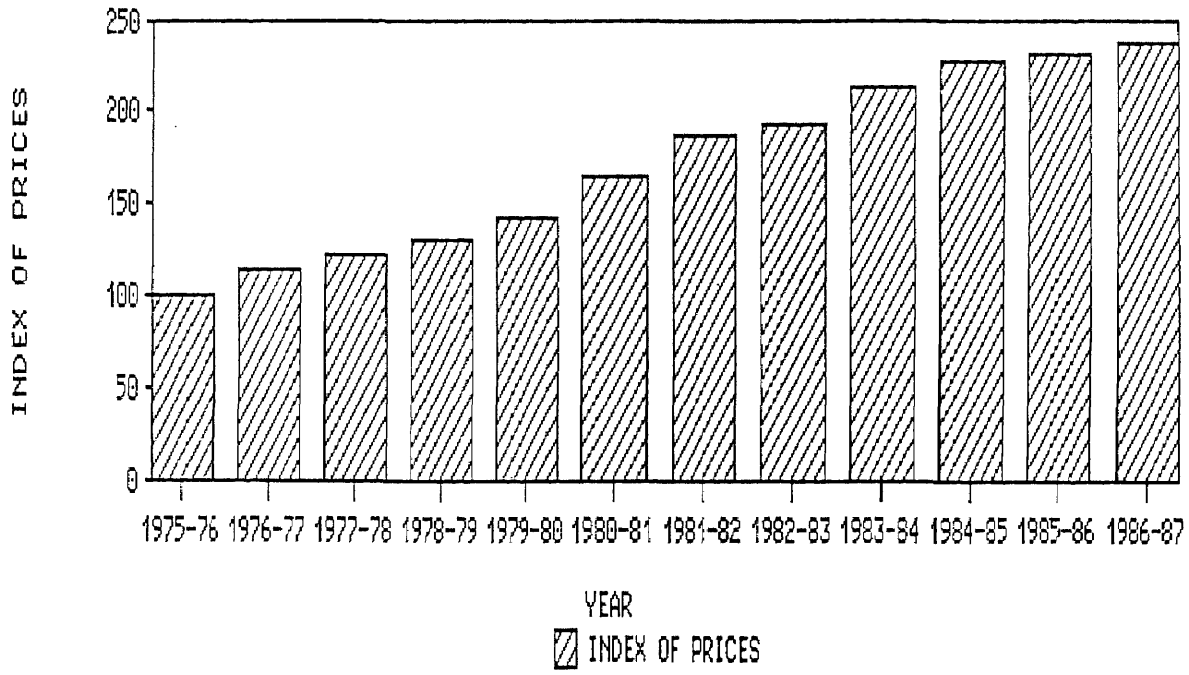


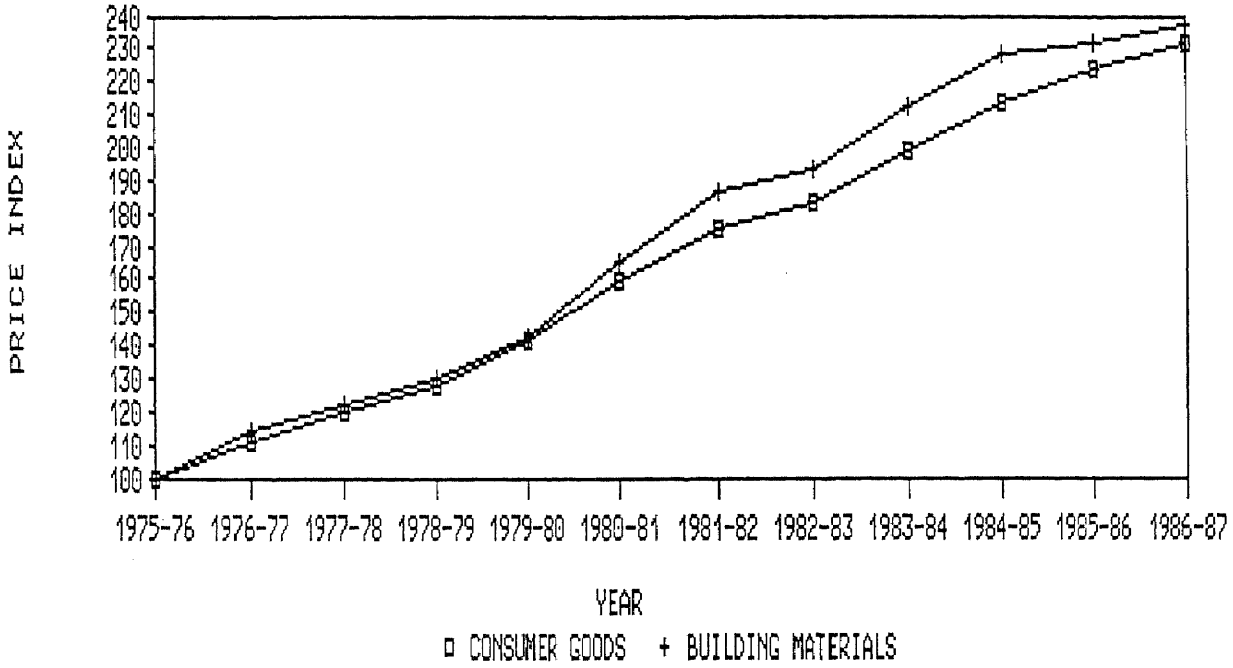
Table 5.2 shows the index of wholesale prices of consumer goods and the building materials. The table (Table 5.2) which is followed by figure (Figure 5.2) shows that the increase in the prices of the building materials is due in part to the general increase in prices of all commodities throughout the country.

Table 5.2

Index of wholesale prices of the consumer goods and the general building materials in the construction industry.

Year	Consumer goods	Building materials
1975 - 76	100.00	100.00
1976 - 77	111.77	114.31
1977 - 78	120.48	122.88
1978 - 79	128.47	130.38
1979 - 80	142.23	143.06
1980 - 81	159.81	165.23
1981 - 82	175.79	187.03
1982 - 83	183.67	194.00
1983 - 84	199.03	213.14
1984 - 85	213.87	228.20
1985 - 86	224.21	232.11
1986 - 87	231.60	238.04

Figure 5.2
PRICE INDEX OF CONSUMER/BUILD.MATERIALS



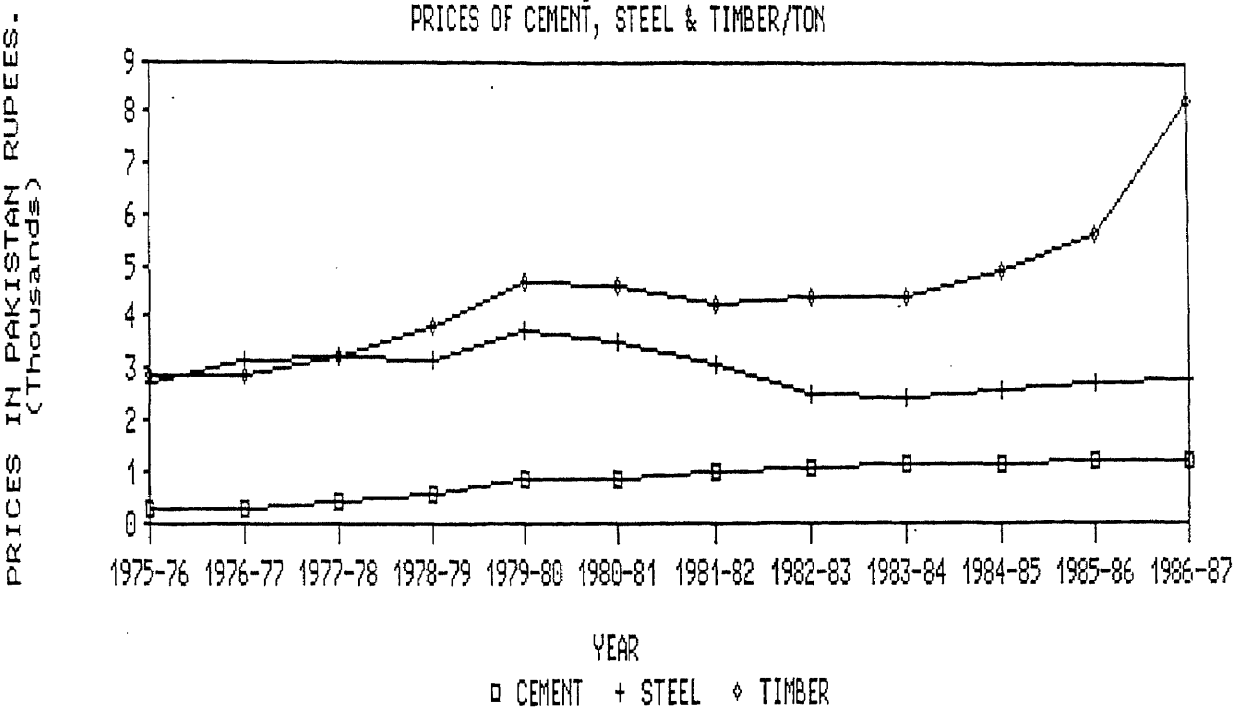
5.3 Table 5.3 and Figure 5.3 shows the average wholesale prices of some of the important building materials (cement, steel and timber) during 1975-76 through 1986-87. It is assumed that other building materials follow the same pattern. The variation in wholesale prices show similar patterns to those for consumer goods and building materials.

Table 5.3

Average whole prices of cement, steel and timber per ton in Pakistan rupees.

Year	Cement	Steel	Timber
1975 - 76	277.15	2724.27	2913.48
1976 - 77	317.10	3229.13	2913.48
1977 - 78	425.07	3230.00	3237.21
1978 - 79	603.00	3219.17	3825.79
1979 - 80	901.50	3756.56	4708.67
1980 - 81	903.00	3574.51	4649.81
1981 - 82	1029.67	3088.20	4296.66
1982 - 83	1062.00	2544.45	4414.38
1983 - 84	1183.00	2501.56	4414.38
1984 - 85	1191.33	2617.99	4907.32
1985 - 86	1268.00	2731.60	5679.83
1986 - 87	1263.00	2819.44	8290.62

Figure 5.3
PRICES OF CEMENT, STEEL & TIMBER/TON



5.4 Table 5.4 and the following figure (Figure 5.4) show the percent annual increase / decrease in the average wholesale prices of cement, steel and timber. This computed data may be used to determine different periods with sharp increase or decrease in percent average wholesale prices.

Table 5.4

Annual percent increase / decrease in wholesale prices of cement, steel and timber.

Year	Cement	Steel	Timber
1975 - 76	---	---	---
1976 - 77	+ 14.40%	+ 18.50%	0
1977 - 78	+ 34.00%	+ 0.02%	+ 11.11%
1978 - 79	+ 41.90%	- 0.34%	+ 18.20%
1979 - 80	+ 49.50%	+ 16.70%	+ 23.10%
1980 - 81	+ 0.20%	- 4.90%	- 1.30%
1981 - 82	+ 14.00%	- 13.60%	- 7.60%
1982 - 83	+ 3.10%	- 17.60%	- 2.70%
1983 - 84	+ 11.40%	- 1.70%	0
1984 - 85	+ 0.70%	+ 4.70%	+ 11.20%
1985 - 86	+ 6.40%	+ 4.30%	+ 15.70%
1986 - 87	- 0.40%	+ 3.20%	+ 45.90%

Refer to Figure 5.4 for details.

Figure 5.4
PERCENT INCREASE/DECREASE IN PRICES

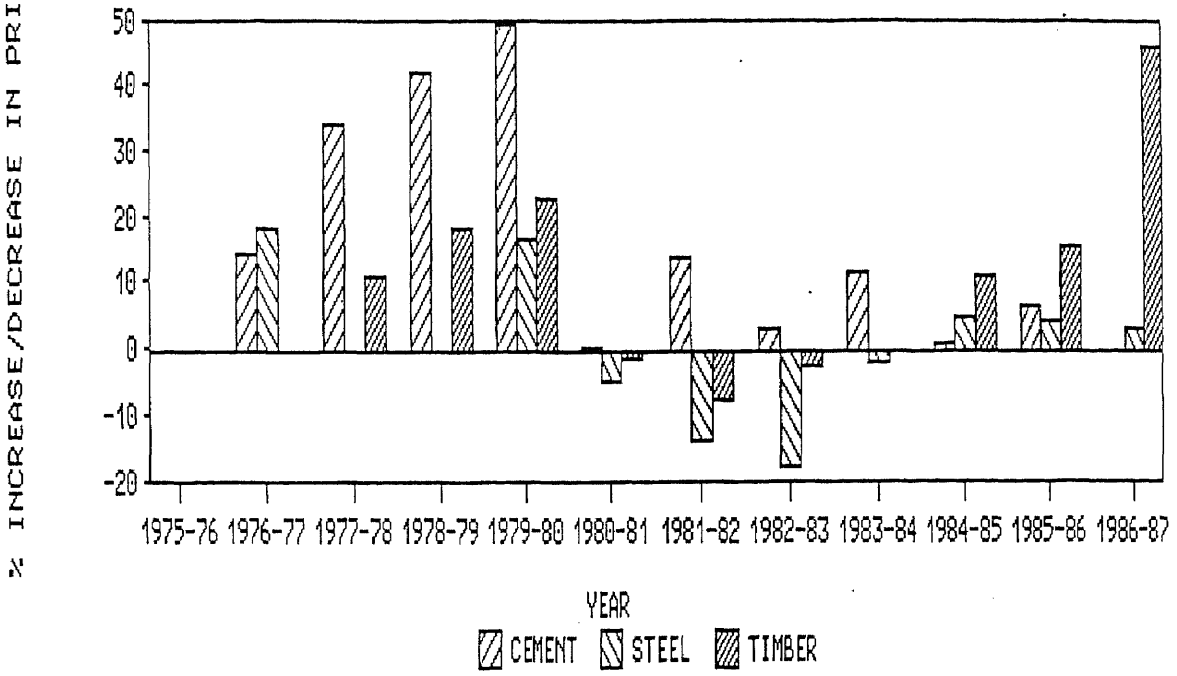


Table 5.5

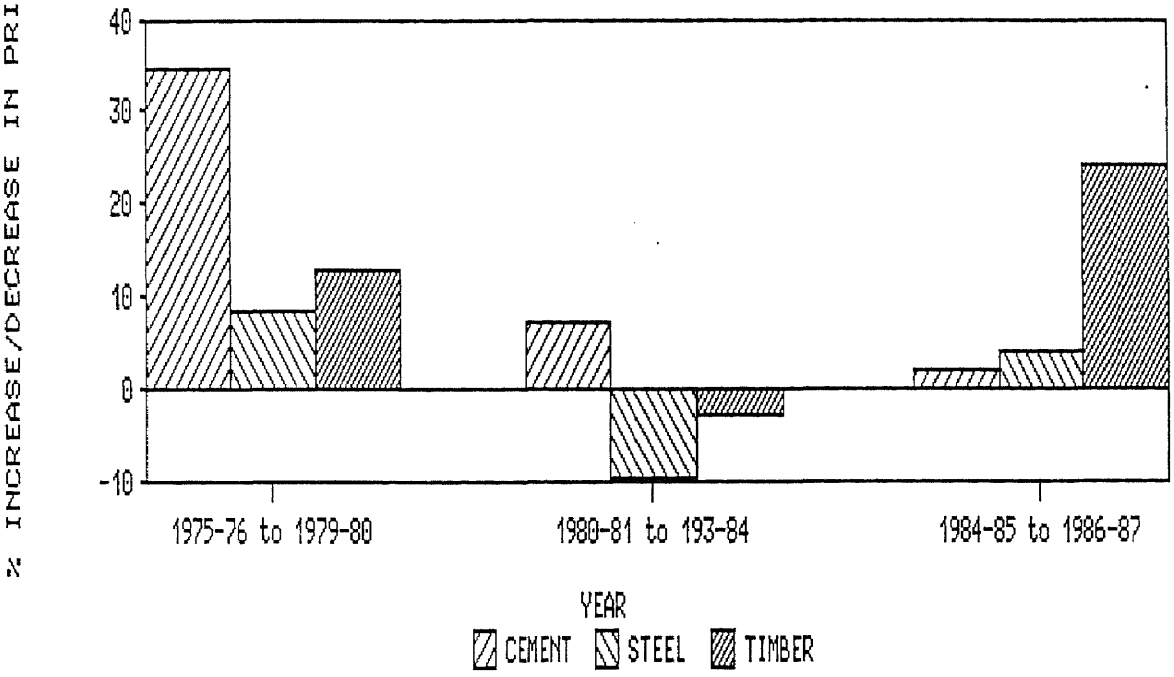
Average percent increase / decrease in the wholesale prices of cement, steel and timber.

Items	1975-76 to 1979-80	1980-81 to 1983-84	1984-85 to 1986-87
Cement	+ 34.95%	+ 7.18%	+ 2.23%
Steel	+ 8.72%	- 9.45%	+ 4.07%
Timber	+ 13.10%	- 2.90%	+ 24.30%

Refer to Figure 5.5 for details.

From the above table it may be noted that the prices of cement increased most (34.95 %) between 1975-76 and 1979-80. Among other reasons mentioned in the previous chapters, this increase in price is directly related to the value added in construction during that period of time, which grew at a very higher rate. (Refer to chapter 1 for details) As the percent growth in the value added in construction gradually decreased, the annual rate of increase in price of cement also decreased. Cement, being the most basic and important material, is the only one which has shown such pattern while the behavior of other materials like steel and timber has been different, indicating involvement of certain other factors which need to be studied.

Figure 5.5
PERCENT INCREASE/DECREASE IN PRICES



CHAPTER 6

LABOR FORCE

6.1 Percent composition.

A regular program of labor force surveys was initiated by the Central Statistical Office (now Federal Bureau of Statistics). The data presented in the following sections / tables is in accordance with the surveys carried out throughout the country during 1985-86.

The following table (Table 6.1) and figures (Figure 6.1 and 6.2) show the labor force as number of workers against total labor force and population.

Table 6.1

Labor force in millions against the population of the country.

Year	Population in(millions)	Labor Force in(millions)	Labor Force in Cons--truction (millions)
1975-76	72.12	21.54	0.92
1976-77	74.33	22.48	1.00
1977-78	76.60	23.46	1.08
1978-79	78.94	24.49	1.16
1979-80	81.36	25.07	1.18

Table 6.1 continued.....

Year	Population in millions	Labor Force in millions	Labor Force in Construction (millions)
1980-81	83.84	25.65	1.20
1981-82	86.44	26.27	1.22
1982-83	89.12	26.91	1.24
1983-84	91.88	27.45	1.37
1984-85	94.73	28.00	1.51
1985-86	97.67	28.05	1.42
1986-87	100.70	28.92	1.46

Please refer to Figure 6.1 and 6.2 which shows the total population, total labor force and the labor force in the construction industry during the last decade.

6.2 In the following table (Table 6.2) growth in the labor force in the construction industry as against the growth in the value added in construction is shown. The data in the Table 6.2 is represented graphically in Figure 6.3 and 6.4 which shows the behavior of growth of the labor force in the construction industry against the growth in the value added in construction.

Figure 6.1
POPULATION AND LABOR FORCE

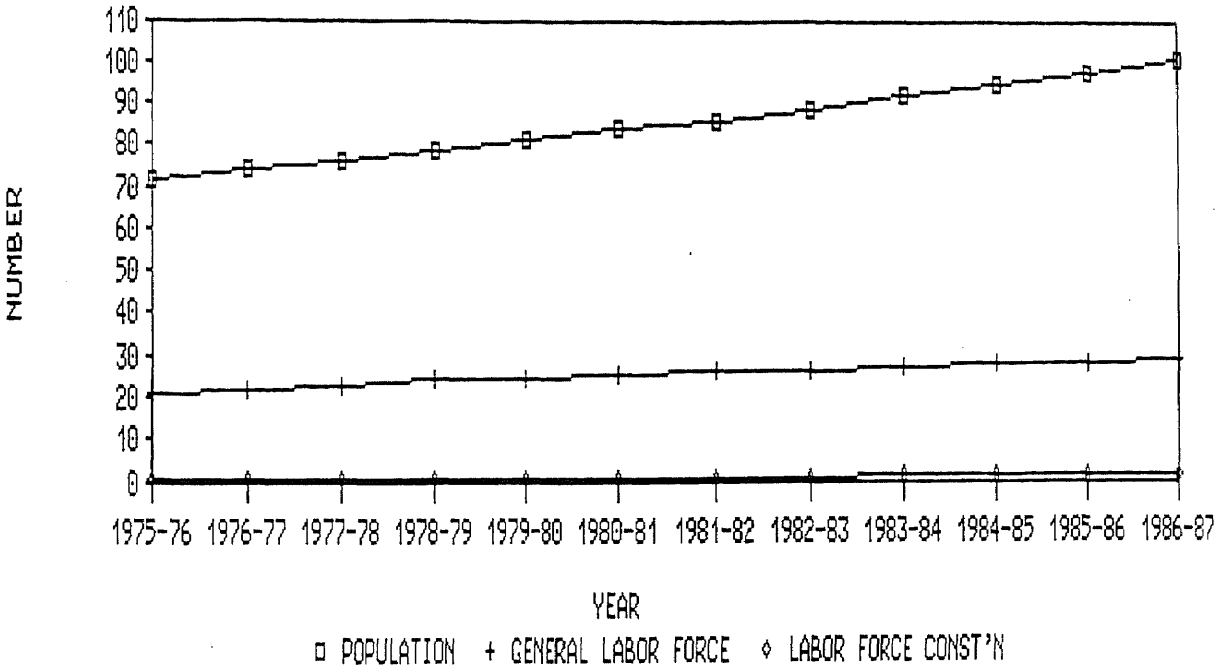


Figure 6.2
POPULATION AND LABOR FORCE

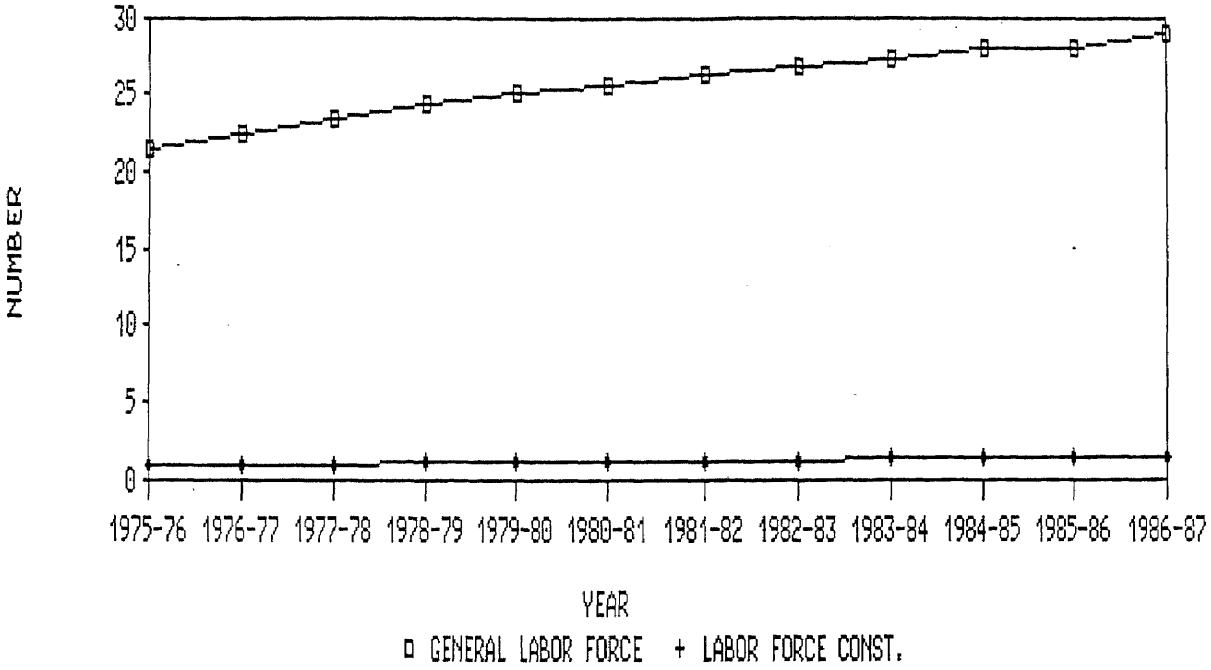


Table 6.2

Year	Labor Force in construction as percent of total labor force	Percent growth per year in the labor force in construction	Percent growth per year in VAC
1975-76	4.37	---	---
1976-77	4.55	+ 8.7	+ 20.7
è1977-78	4.73	+ 8.0	+ 16.6
1978-79	4.92	+ 7.4	+ 15.6
1979-80	4.89	+ 1.7	+ 20.9
1980-81	4.86	+ 1.7	+ 20.5
1981-82	4.83	+ 1.7	+ 13.4
1982-83	4.80	+ 1.6	+ 16.2
1983-84	5.18	+10.5	+ 23.6
1984-85	5.60	+10.2	+ 12.2
1985-86	5.24	- 6.0	+ 13.1
1986-87	5.24	+ 2.8	+ 15.7

VAC --- Value Added in Construction (current value)

Refer to Figure 6.3 and 6.4 for details.

Figure 6.3
LABOR FORCE AS % OF TOTAL LABOR FORCE

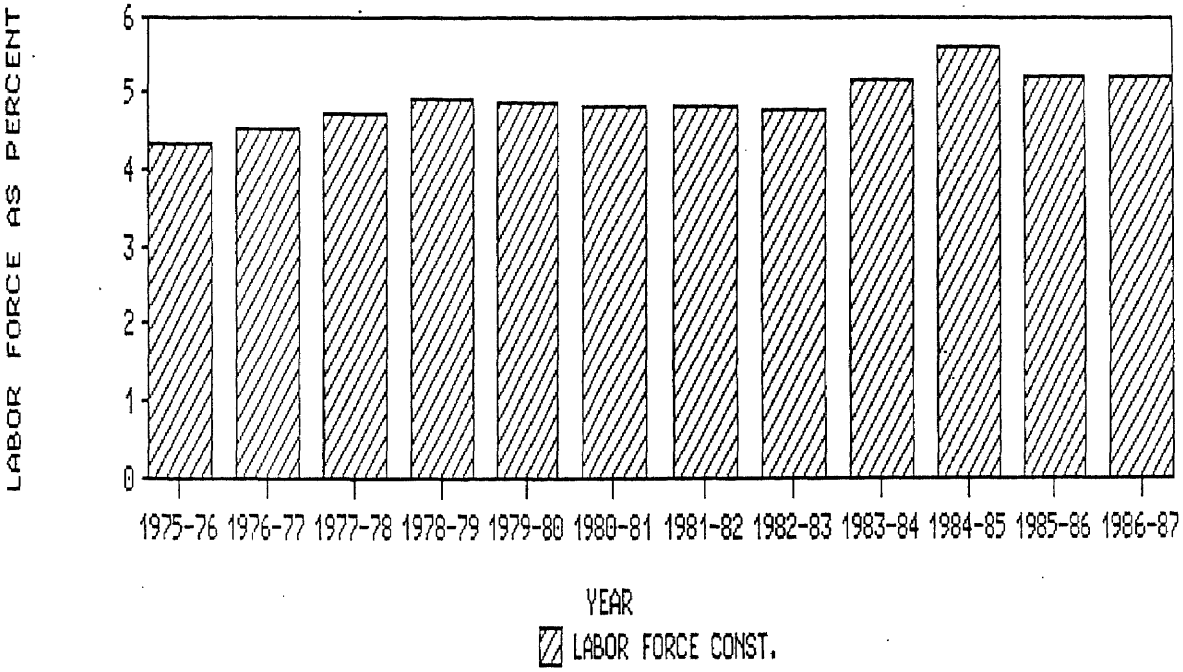
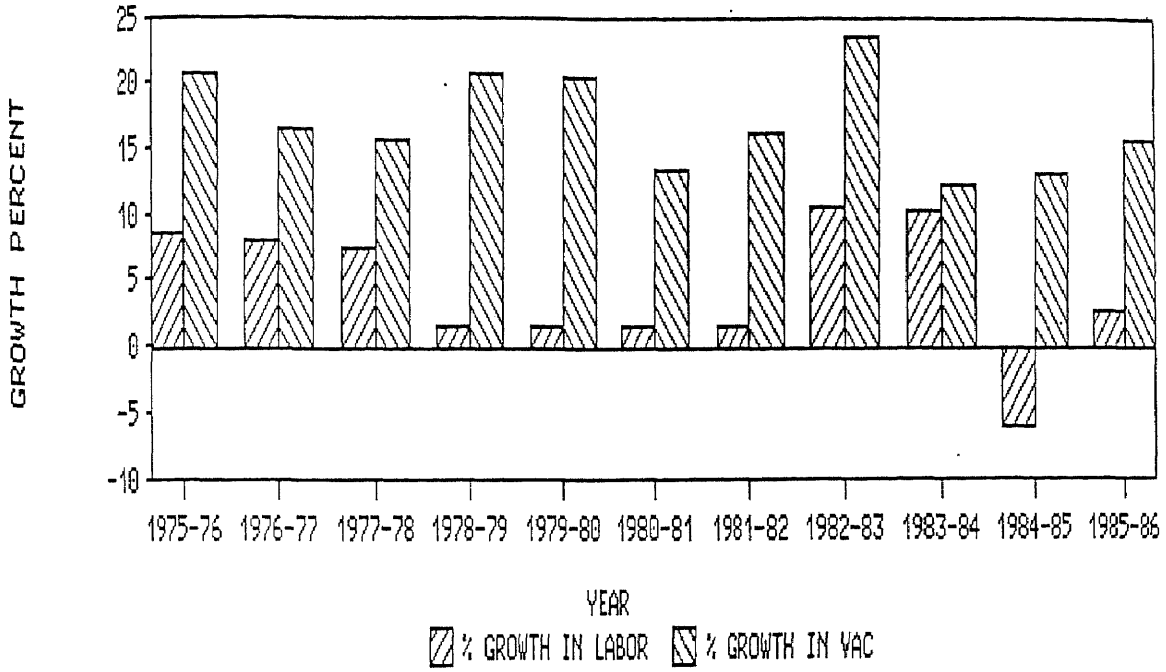


Figure 6.4
% GROWTH IN LABOR FORCE/VAC



6.3 In the following table (Table 6.3) and figure (Figure 6.5), average rate of increase of the labor force in the construction industry for different periods in the last decade are compared with the average rates of increase in the value added in construction during the same periods.

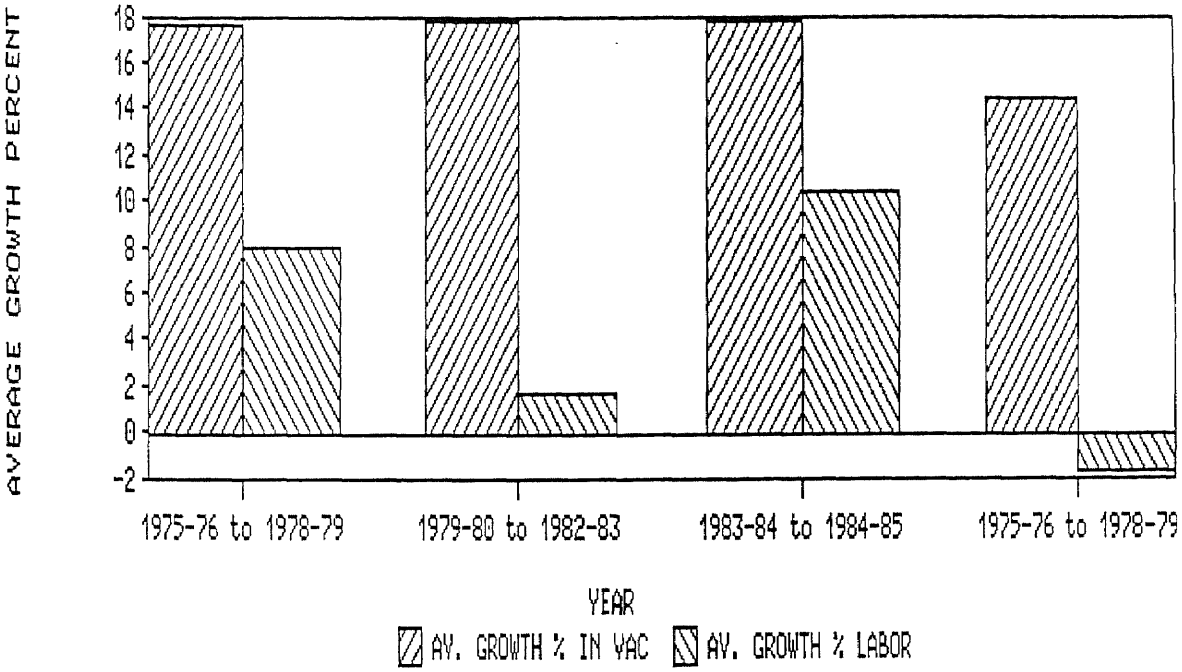
Table 6.3

Average percent growth per year in the labor force and the value added in construction.

Items	1975-76 to 1978-79	1979-80 to 1982-83	1983-84 to 1984-85	1985-86 to 1986-87
Average percent growth per year in the Value Added in Construction	+17.6	+17.8	+17.9	+14.4
Average percent growth per year in the labor force in construction	+ 8.0	+ 1.7	+10.4	- 1.6

Refer to Figure 6.5 for details.

Figure 6.5
AV. % GROWTH IN LABOR FORCE/VAC



6.4 It may be seen from the previous tables (Table 6.2 and 6.3) and figures (Figure 6.4 and 6.5) that the percent growth per year in the labor force in construction during 1975-76 to 1986-87 was much lower than the percent growth per year in the value added in the construction during the same period of time. This behavior may be explained by the the impact of labor immigration to the countries in the middle east in particular and the countries offering higher salaries and benefits in general.

There were particularly two periods (from 1979-80 to 1982-83 and 1985-86 to 1986-87) when the average growth per year in the labor force in the construction was + 1.7 and - 1.6 percent respectively, whereas the average growth per year in the value added in construction was + 17.8 and + 14.4 percent respectively.
Thus it may thus be concluded that during these two periods, there was maximum immigration.

If this trend continues severe labor force problems may be expected in the future. The only possible solution at this time is a revision of salaries and benefits. This may possibly reduce the immigration.

CHAPTER 7

ORGANIZATION AND STRUCTURE OF THE CONSTRUCTION INDUSTRY

7.1 The construction industry as a whole has made fairly rapid progress during the last decade both in confidence and capability. The two major factors contributing to this are :

The decision of the government of Pakistan to entrust construction of Pakistan steel mill to domestic contractors, and

The opening of construction possibilities in the middle east.

Construction firms in both the public and private sectors are now operating in the middle east.

7.2 Categorization

The construction industry may be classified according to the size of the firm, nature of construction, level of sophistication and technical expertise present in the construction firms.

A correlation may be found between the size of the firm and level of sophistication and technical expertise required in the construction process. The following classification may be noted :

	Organization	Type of construction
1.	Class A / Large firms (Professional management)	Modern international
2.	Class B firms / Contractors (Owner managed)	National modern
3.	Class C firms / Contractors (Supervised by house owner)	National conventional
4.	Self help	Traditional

7.3 'Modern international' means construction of a quality which is comparable to that in developed countries. It includes major civil engineering works, high rise public and private buildings in large urban centers etc. It is international in the sense that it not only employs latest methods and systems in construction but also includes extensive use of imported material, plants, equipment and machinery.

7.4 The 'national modern' category may be regarded as second to the international modern. It is involved in urban areas both in the public and private sectors, with quality standards scaled down and adapted to local conditions. This type of construction requires relatively simpler application of technical skills and machinery.

7.5 The 'national conventional' may be considered as a movement towards modernization. It requires very simple techniques and depends upon few selected inputs such as cement, corrugated steel, glass, paints, etc. This is the kind of construction usually found in the areas (mainly rural) of lower income groups. This is a neglected sector and needs greater attention and priority. Please refer to the discussion on low-cost housing in the introduction.

7.6 In this study concentration is given on the capacity of modern international (Class A) and modern national (Class B) sectors because major constraints of technical knowledge, imported inputs (such as material, plant, equipment, machinery etc.) and skilled labor are present. Besides most of the important development projects within the public and private sectors lie in these two categories.

In the case of 'national conventional' the requirements of highly skilled labor, imported material inputs and technical knowledge is very limited. In many respects this sector is important and much attention is needed for the improvement of the housing conditions and low cost housing. This has been discussed in detail in the introduction and will not be discussed further in this study.

7.7 The international modern (Class A) and the national modern (Class B) sectors are comprised of large firms/contractors.

The main difference between the two appears to be the organization. The former is managed by professionals while the latter is owner managed (individual) and has limited technical and professional competence.

7.8 Domestic capabilities

It is generally believed that firms specialize in a particular type of construction work such as buildings (residential and non-residential), heavy engineering construction, highways etc. Although, it is considered difficult for firms engaged in the construction of residential and non-residential buildings to move into heavy engineering construction, highways etc, and vice versa, but movement has been regarded as more feasible and most of the

larger firms have listed their organizational and technical capability as covering more than one area of work.
The capabilities in the various sub-sectors are as follows :

a) **Housing:**

Because of the nature of the housing construction, a major part of it is covered by the national modern and national conventional categories. This is mostly dominated by small sized contractors. It requires a small capital outlay and relatively modest degree of professional and technical skill for executing the work. The capacity in this sector is adequate provided the necessary material inputs are available. Unless the number of trainee workers is increased skilled labor may become a constraint if the present immigration pattern continues.

b) **Industrial and large commercial buildings:**

Since the capital requirements are greater and the construction more technical, large sized firms are involved in this area. Besides a few large sized Pakistan based foreign firms, most of the firms engaged in this area are Pakistani firms and there has been a significant development in the capacity and capabilities in this field of work.

c) **Heavy civil engineering:**

Untill recently all the major projects such as Indus Basin Replacement Works, Warsak Dam, etc., had been done by the foreign contractors.

The consultants had recommended in the report prepared in 1975 that the domestic construction industry should be given more difficult projects in order for it to develop the necessary capability and confidence. Subsequently there was a change in the government policy, as a result of which during the last several years this particular sector had developed very rapidly. Most of the development resulted from the decision of the Pakistan Steel Mills Corporation to entrust nearly all the construction work to Pakistan based contractors.

Initially there were strong feelings at the Pakistan Steel Mills Corporation that the construction capability of Pakistani contractors both with regard to volume and quality was inadequate to meet the construction requirements of the Steel Mill. This opinion was also shared by the top ten Pakistani contractors who were initially reluctant to offer bids for civil works because they felt that they did not have the necessary experience to do such large construction

work which demanded high level of performance and quality control.

This reluctance was also based on the fact that the capabilities of the Pakistani contractors for executing mechanical and electrical works was extremely limited. Another factor was based on the fact that construction machinery and equipment of the leading firms was very limited with regard to capacity and reliability required to handle high volume of construction work. To overcome this problem the Steel Mills Corporation decided to provide heavy machinery, equipment and mechanized construction facilities to the contractors. The Steel Mills Corporation also arranged to supply important construction materials like steel of certain specifications, cement etc. The supervision of the Soviet experts in the area of project planning has also helped the Pakistani contractors to complete the work satisfactorily.

As a result the physical capacity of the contractors have increased and the contractors had increased their investment on training construction personnel and acquiring heavy construction equipment and machinery. An example of the local contractors willingness to actively participate in the construction work at the steel mill is the construction work

of Billet Mill. In the past when this job was offered for bids, only two contractors submitted quotations.

This work was re-tendered in april 1980 and ten contractors submitted their bids. The construction work of the Billet Mill was awarded to a firm which was not in the top fifteen firms of the country. The work was completed satisfactorily. A summary of the details of the construction of the steel mill is given in table 7.1, 7.2 and 7.3.

Table 7.1

Volume of the construction work at the Steel Mill

Type of Work	Volume of work
Excavation	5.74 Million Cu.Meter
Filling	4.33 " "
Insitu concrete	0.99 " "
Prestressed conc.	0.035 " "
Piling	0.029 " "
Reinforcement Steel	74.0 Thousand Tons
Steel Structures	137.0 " "
Refractories	72.0 " "
Technological equip.	147.0 " "
Motor roads	363.0 " "
Railway Tracks	47.0 Kilometers
Water/Sewerage Pipes (indoor)	103.0 "
Water/Sewerage Mains	236.0 "

Table 7.2

Schedule for the award of contracts

Work awarded up to 07/1978	1448 million Pak Rs.
Work awarded from 08/1978 to 12/1979	1182 " "
work awarded from 01/1980 to 12/1980	400 " "
Total	3030 " "

Table 7.3

Details of award of works at the Steel Mills (Rs.in Million)

Shops	Stage	Schedule of Construction		Estimated Value	Value Awarded
		Date Start	Date Finish		
Repair Shops	1	02/76	11/78	130.00	118.29
Coke-Oven and By Product Plant	1	05/76	12/78		
" " "	2	-	06/81	210.00	207.26
TPP/TBS	1	08/76	12/78		
" "	2	01/80	06/81	60.00	61.95
Iron Making Plt.	1	08/76	06/79		
" " "	2	01/79	06/81	150.00	113.63
Refractories & Lime Product Plt	1	02/77	12/78		
" " "	2	-	05/81	100.00	106.14

Table 7.3 continued.....

Shops	Stage	Schedule of Construction		Estimated Value	Value Awarded
		Date Start	Date Finish		
Raw Material Preparation Plt	1	03/76	09/78		
" " " "	2	-	12/80	290.00	281.10
Steel Making Plant	1	03/77	03/79		
" " "	2	-	12/81	380.00	350.97
Oxygen and Gas Facilities	1	07/78	02/79	40.00	32.50
Water Supply and Sewerage	1	02/77	09/78		
" " "	2	-	03/80	350.00	300.19
Transport and Communication	1	02/78	03/79		
" " "	2	10/78	01/80	250.00	208.00
Billet Mill	1	04/78	-	80.00	74.62
Administrative & Welfare Bld.	1	-	09/80		
" " "	2	-	03/82	120.00	120.00

Table 7.3 continued.....

Shops	Stage	Schedule of Construction		Estimated Value	Value Awarded
		Date Start	Date Finish		
Hot rolling mill	2	04/78	03/82	390.00	390.00
Instrumentation & automation Plant	1	03/77	09/78	80.00	34.80
Cold Rolling Mil	2	01/80	06/83	400.00	400.00

d) **Highways:**

The only major highway which is to the international standards is the Karachi-Hyderabad super highway, which was built by foreign contractors. During early 1970's a world bank highway project was dropped because no domestic contractors were pre-qualified and the bids submitted by foreign contractors were very high. If the steel mill example is followed there is no doubt that highway projects can be successfully carried out as the problems involved in highway construction are less compared to the heavy engineering works.

During the same period of time, when the construction of Pakistan steel mill was in the initial phase of construction, the Pakistani contractors were also getting involved into the construction of buildings, roads/highways, bridges/dams, flood protection works, canals, tunnels, water supply works etc. The following tables (Table 7.4, 7.5 and 7.6) and figures (Figure 7.1, 7.2, 7.3, 7.4, 7.5 and 7.6) show the value (in millions of Pak. Rs.) of different works undertaken by the category of contractors between 1974-75 and 1976-77.

Please refer to Table 7.7, which shows the total maximum capacity as claimed by the construction companies/contractors between 1974-75 and 1976-77.

Table 7.4

Value of work undertaken in 1974-75

by category of contractors.

Item	Total Value in Million Pak.Rs.	No. of Contractors
Buildings	234.31	67
Roads/Highways	58.31	26
Bridges/Dams/Barrages	30.49	10
Flood Protection Works	14.15	3
Canals	0.70	1
Tunnels	------	-
Water Supply	0.08	2
Other	106.25	18
Total	445.04	127

Figure 7.1
VALUE OF WORK DURING 1974-75

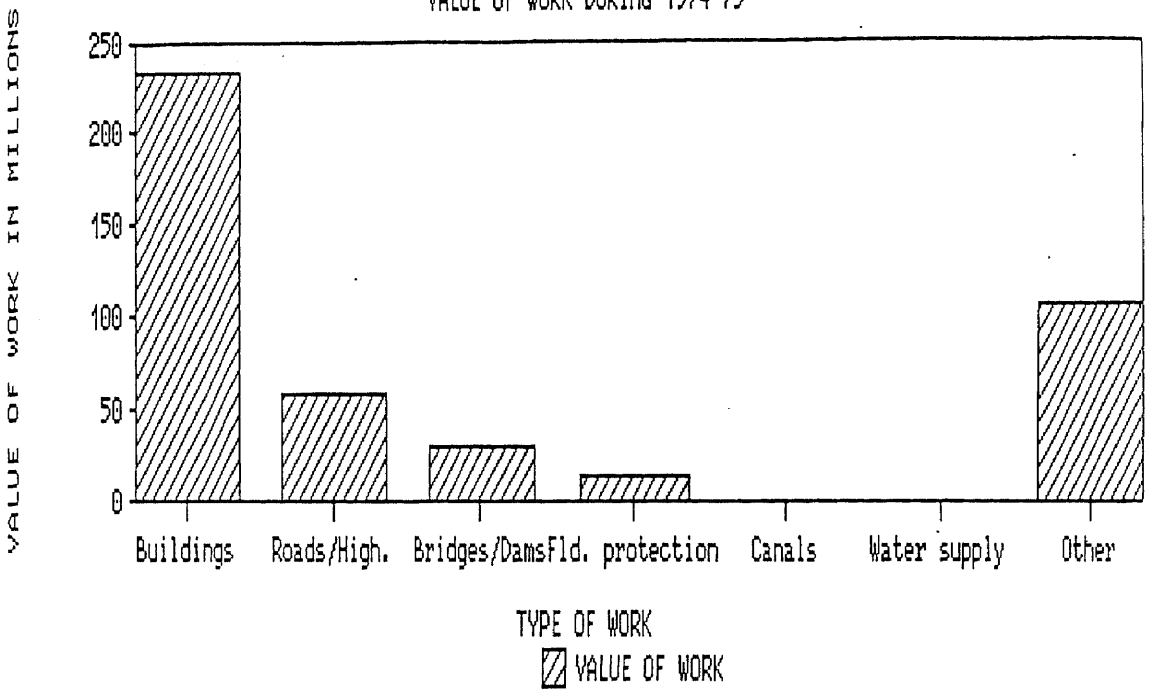


Figure 7.2
NO. OF CONTRACTORS DURING 1974-75

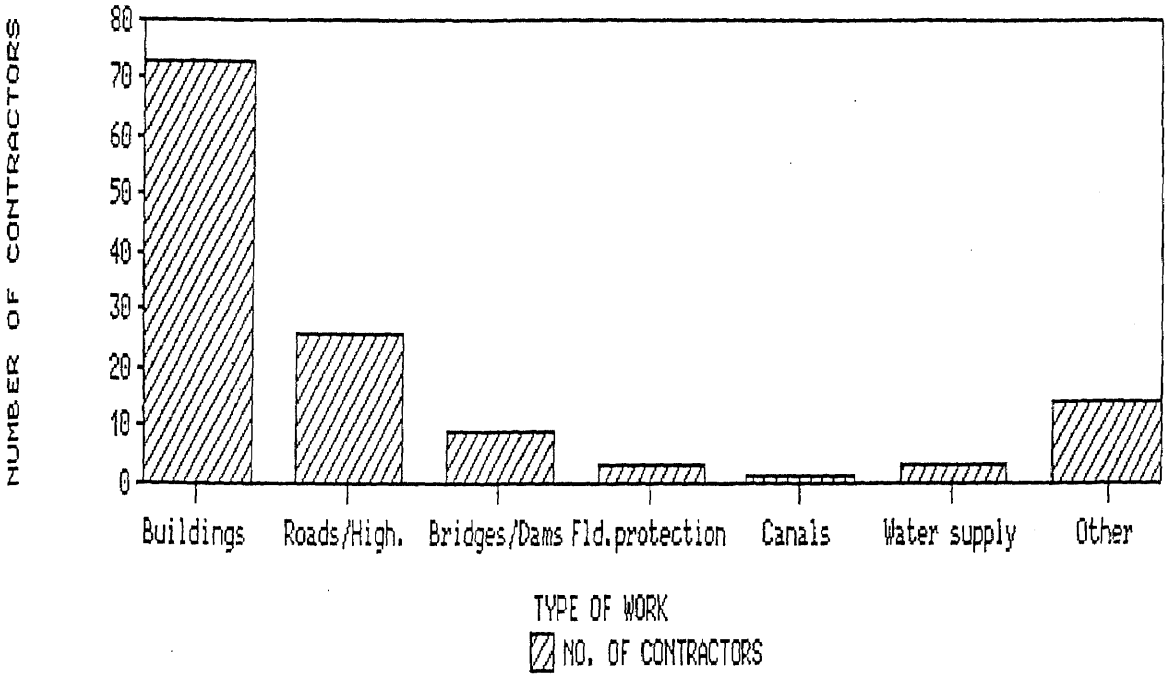


Table 7.5

Value of work undertaken in 1975-76

by category of contractors

Item	Total Value in Million Pak.Rs.	No. of Cont
Buildings	386.09	73
Roads/Highways	67.39	26
Bridges/Dams/Barrages	47.10	9
Flood Protection Works	23.13	3
Canals	0.55	1
Tunnels	14.55	1
Water Supply	13.76	3
Other	154.42	14
Total	706.98	130

Figure 7.3
VALUE OF WORK DURING 1975-76

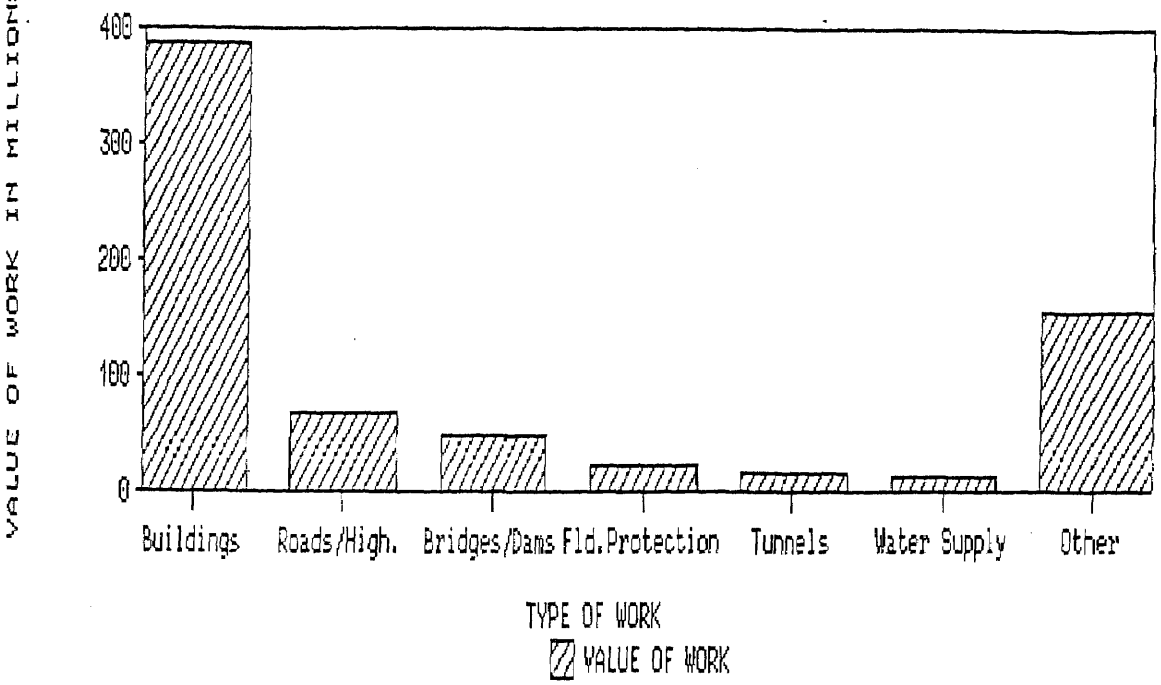


Figure 7.4
NUMBER OF CONTRACTORS DURING 1975-76

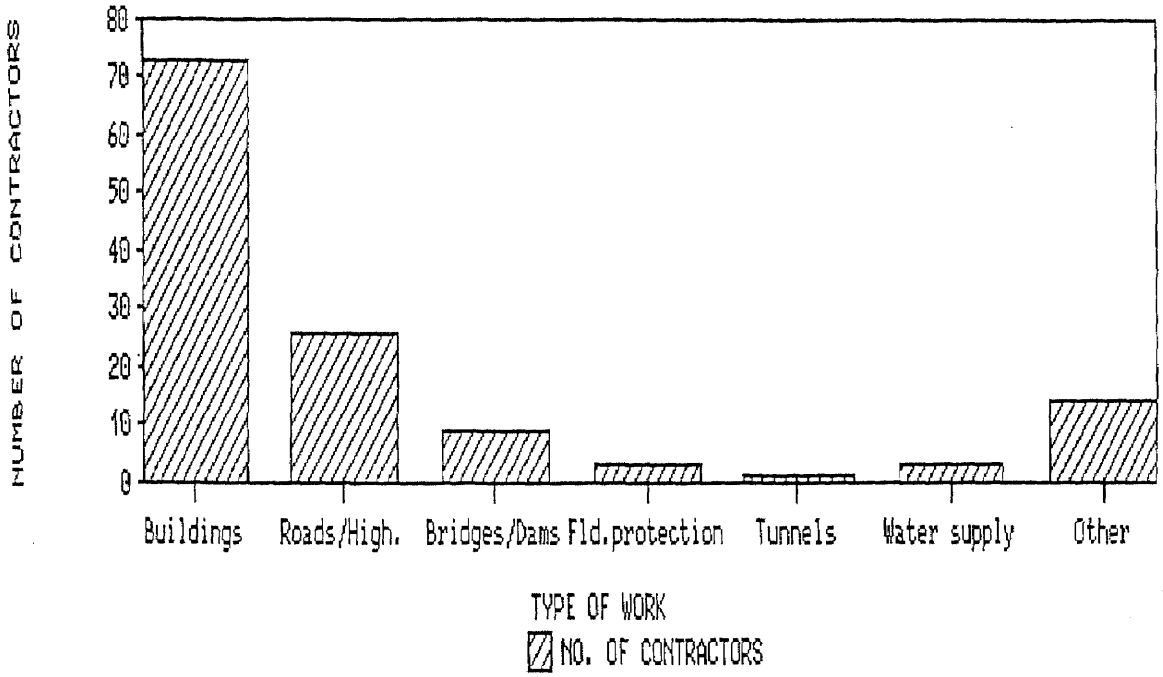


Table 7.6

Value of work undertaken in 1976-77

by category of contractors

Item	Total Value in Million Pak.Rs.	No. of Contractors
Buildings	464.70	69
Roads/Highways	74.48	27
Bridges/Dams/Barrages	45.04	9
Flood Protection	24.66	3
Canals	0.50	1
Tunnels	15.64	1
Water Supply	57.25	3
Other	233.10	14
Total	915.37	127

Figure 7.5
VALUE OF WORK DURING 1976-77

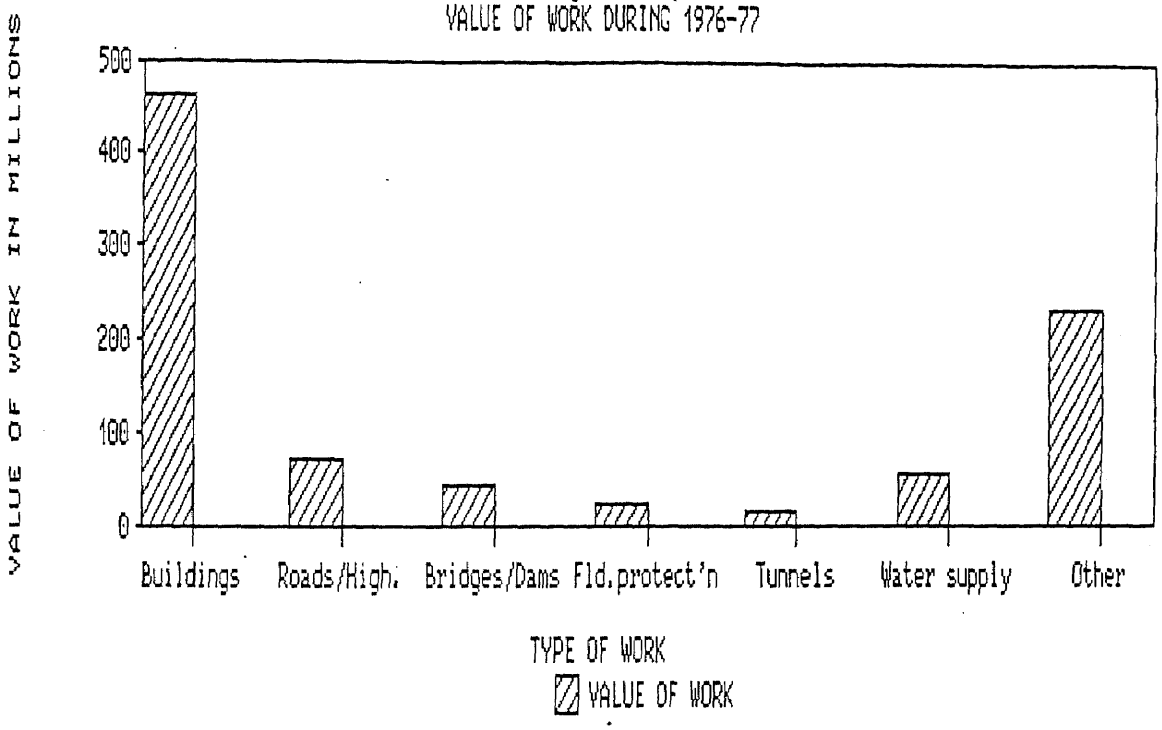


Figure 7.6
NO. OF CONTRACTORS DURING 1976-77

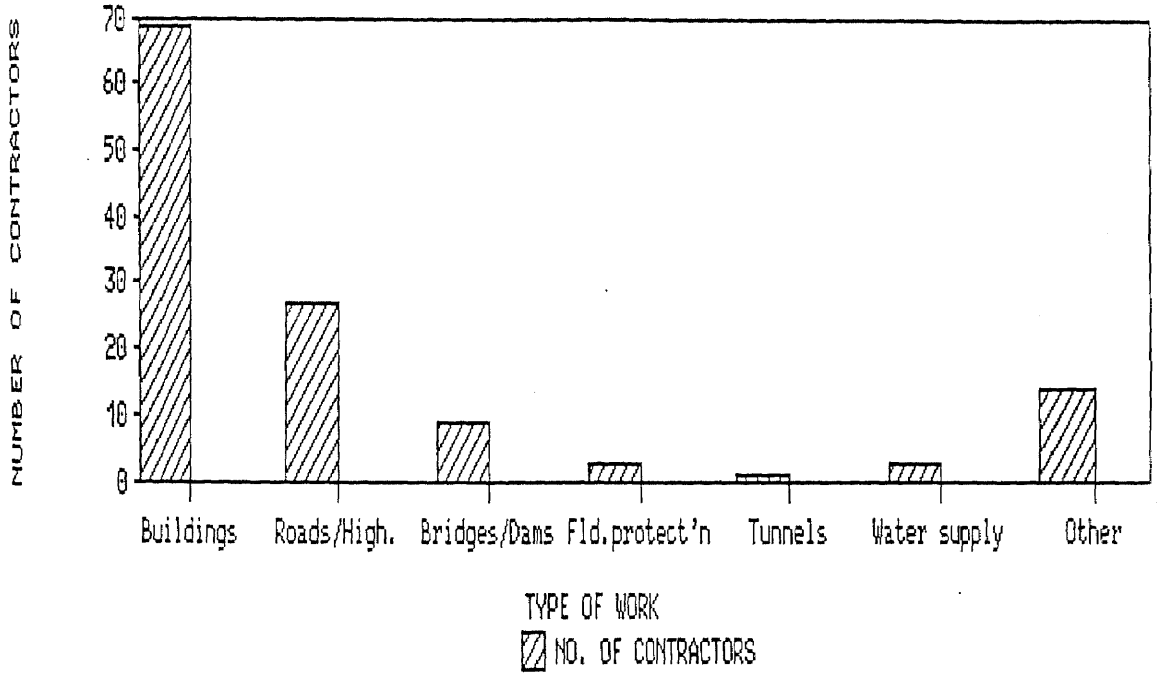


Table 7.7

Total maximum capacity as claimed by construction companies/contractors

Item	Maximum Capacity in Million Pak.Rs.	No. of Contractors	Year
Buildings	655.79	67	1974-75
"	854.75	66	1975-76
"	913.10	68	1976-77
Roads, Highways, Bridges & Dams.	133.55	32	1974-75
" " "	220.37	32	1975-76
" " "	199.20	30	1976-77
Other Construction	292.02	22	1974-75
" "	407.13	20	1975-76
" "	394.49	21	1976-77
Total	1083.34	121	1974-75
"	1482.24	118	1975-76
"	1506.79	119	1976-77

7.9 Distribution of firms by the size of annual turnover

The total number of contractors including large firms and contractors registered with the public agencies has been estimated to be approximately 2,250. They are classified on the basis of their capacity to perform work. Out of the 2250, 364 were classified as without any upper financial limit. These registration classifications are not directly related to annual turnover. Since we are concerned with the capacity of the construction industry on the basis of annual output, we therefore classify the contractors on the basis of the work done. While calculating the value in current rupees, inflation has to be taken into account as prices for different items have increased from 20% to 35% throughout the country.

7.10 In the survey carried out by the Planning Division, Government of Pakistan, the total number of the contractors covered were 101. Although the names for the survey were drawn on a random basis there were two distinct factors operating in the favor of larger firms: first, the larger the firm the more easily it could be located; and second, the size of the firm which influenced the availability of its personnel for providing the information. In view of

these factors and subsequent examination of the data, it became reasonably clear that the probability of the firm appearing in the sample increased sharply with size. These factors were considered when the data collected was computed to estimate the capacity of the firms in general. The distribution by the amount of work done in 1976-77 is given in table 3.8.

Table 7.8

Distribution by the size

Size of the firms		Sample Size	Estimated no. of Contractors
up to 1.0	Million Rs.	35	1405
From 1.1 to 2.5	"	23	606
2.6 to 5.0	"	16	136
5.1 to 15.0	"	14	64
15.1 to 50.0	"	7	28
Above 50.0	"	6	7

7.11 Patterns of ownership and growth

On the basis on the survey carried out the following ownership pattern was determined.

Table 7.9

Type of ownership

Category Pak.Rs. in Million	Type of ownership				
	Sole Proprietorship	Partnership	Private	Public	Govt. Spon'd
	(PERCENT OF CONTRACTORS)				
up to 2.5	40 %	50 %	10 %	-	-
2.6 - 7.5	12 %	42 %	46 %	-	-
7.6 -15.0	17 %	-	83 %	-	-
Above 15.0	-	-	85 %	15 %	-

The nature of ownership and organization has changed after 1980 and there has been a general decline in the sole proprietorships and increase in private limited companies.

3.12 Before 1971 there was only one Pakistan based firm with a turnover of over 7.5 million rupees. Most of the large firms in construction industry which are now in business were established during 1960's and are moving consistently towards progress. It also reflects the effect of projects such as Indus Basin Replacement Works and Pakistan Steel Mills which stimulated the local industry through sub-contracting by the larger expatriate construction firms.

The industry may now be considered to have entered into a phase of maturity and consolidation, although many new firms had registered themselves as contractors in the last several years. A comparison of the proportion of work done by small, medium and large contractors during 1973-74 and 1976-78 gives an indication of the trend.

Table 7.10

Work done by the registered contractors

Size of the firms in million Pak. Rs.	1973 - 74	1977 -78
up to 2.5	53.7 %	41.4 %
2.6 - 15.0	23.9 %	26.3 %
Above 15.0	22.4 %	32.3 %

The amount of work by the large contractors has increased the most and the work done by the small contractors has decreased.

7.13 Financial structure and capabilities

There was considerable reluctance for providing specific or detailed information about equity, investment, working capital and borrowings. Large percentage of the firms did not provide information on these points. The information on borrowings is not very reliable and there is a certain amount of hesitation among smaller contractors to disclose their position. Shortage of credit is one of the main complaints of the industry. The use/availability of the credit by the size of the construction firms during 1976-77 may be seen from the following table (Table 7.11)

Table 7.11

Borrowings during the financial year during 1976-77

Category in million Pak.Rs	Number of Contractors	% Contractors borrowed	Average borrowing per contractor
up to 2.5	58	21 %	24,553 Rs.
2.6- 7.5	24	43 %	401,087 "
7.6-15.0	6	67 %	2,416,667 "
Above 15.0	13	62 %	3,412,500 "

7.14 Some indication of the financial constraints may be obtained by taking the relationship between the average investment and the average turnover for each category in table 7.11

Table 7.12

Ratio of turnover to investment

Category in million Pak.Rs	Turnover / Investment		Change during period.
	1973-74	1976-77	
up to 2.5	7.1	4.1	42 %
2.6- 7.5	5.1	4.6	10 %
7.6-15.0	7.0	-	-
Above 15.0	6.1	5.9	3 %

When the data is compared for 1973-74 with that of 1976-77 it is seen that the industry was somewhat less dependent on borrowing finances during 1976-77. This trend continued through the 1980's (until 1984-85). Please refer to the following table (Table 7.13) for details.

Table 7.13

Borrowings as percent of the Value added in construction by the construction industry (public and private sectors) in millions of Pak. Rs

Year	Total borrowing by the construction industry (Public and private sectors)	Borrowing as percent of VAC
1981-82	1184.7	9.7
1982-83	1230.3	8.5
1983-84	2174.7	11.3
1984-85	2854.5	10.8
1985-86	4976.9	16.4

7.15 The smaller contractors are particularly less dependent on borrowing due to the main reason that it is not available to them. The second reason is the high interest rates.

Financial capability affects the organization in general and flow of materials in particular and therefore directly influences the efficiency of the industry.

7.16 Liquidity problems are also created because of earnest money, retention and security requirements.

For furnishing guarantee for the purpose of obtaining mobilization advance from the client or for providing performance bond the contractor can obtain necessary guarantee from a scheduled bank or insurance company if it acceptable to the client.

The banks usually avoid giving guarantee for performance bond but do so for mobilization, but the insurance companies provide for both. The banks as well as insurance companies require collateral for the purpose of giving guarantee.

CONCLUSION

FUTURE DEVELOPMENTS AND PROBLEMS

Capabilities of construction companies:

The main issues relate to the general improvement in management and building techniques in the construction industry, and the creation of technical and organizational capabilities within the industry to undertake large and complex projects. During the last decade, instead of concentrating on these aspects, the construction industry was more concerned with the availability of cement, timber, skilled manpower, and technical and professional personnel.

Until 1975, only a few foreign based international firms were almost exclusively engaged in carrying out heavy civil engineering works in the country, while the domestic firms were mainly doing work of simpler nature. The position changed after 1975 with the involvement of Pakistani firms in the construction of Steel mill, Port Qasim etc. The Steel mill provided special incentive for the domestic firms in expanding their capabilities to do work of greater complexity.

This has not only resulted in the increase in capability of the top 10 firms but in general has also increased the capacity of class A firms who in the past were reluctant to undertake projects of complex nature.

Labor productivity

Due to large scale immigration of construction labor to the Gulf and Middle East, trained manpower has become a constraint for this industry. With rapid turnover of skilled workmen, less experienced workers are assigned jobs which were previously done by the workers with higher skills and experience. The general quality of work has thus declined. The contractor who has to ensure work according to the specifications incurs additional supervision costs.

The industry is also facing a serious shortage of experienced professionals, which has shown a rising trend since 1975. According to the data available approximately 30% of the annual output of the engineers left the country each year from 1973 onwards. Inspite of the decline in this figure in recent years, the shortage of the experienced professionals is significant. The only solution at this point is better utilization of the professional staff for higher output.

Labor availability

As indicated in paragraph 8.3, the construction industry is facing problems concerning the supply of skilled labor and technical professionals. The traditional apprenticeship method is still being used to reduce the requirement resulting from the increase of demand in the domestic construction industry and also immigration of skilled persons to countries which offer higher salaries.

During the last couple of years there appears to be a reduction in demand for technical persons in the Gulf and Middle East, because of the policies adopted by the Organization of Petroleum Exporting Countries (OPEC) and also to compensate for over rapid expansion in construction projects. This situation is likely to change and the demand for technical persons might increase resulting in an impact on the domestic construction industry.

It is therefore important to introduce and implement programs for the development of skills required for the construction industry, particularly masons, carpenters, steel fixers, plumbers, electricians, machine operators and so forth. Another reason for doing this is to keep the

domestic wages at reasonable level. This is an important factor as labor costs comprise approximately 20% of the total in most types of construction projects.

Construction Techniques

Given the rising trend of prices of material inputs such as steel, cement, bricks, timber, etc., only proper application of construction techniques can cut the project costs. Because of quality control problems, most of the present structures are over designed in terms of material inputs. More economical designs could be employed to cut the costs. For example, in case of concrete pre-cast columns and beams could be used without difficulty in structures of up to five and six levels. This will also reduce the labor, cement, steel, shuttering costs etc. Another factor is the increasing prices of gasoline which has affected transportation costs and has gained added importance. Detailed study of the material inputs required in building construction is necessary to realize economies in design, production and transport.

Machinery and equipment imports

During the last decade there has been an increase in machinery and equipment imports by private contracting firms because of the liberal government import policy towards the import of construction and industrial machinery and equipment. Inspite of the above mentioned fact, the number of construction machinery and equipment is still inadequate. Another problem is the supply of spare parts which are always in shortage. Improvements in the import policy for spare parts is necessary to solve this problem.

Presently good opportunities exist for leasing or purchasing surplus equipment lying in the Middle East and the Gulf states due to the reduction in the construction activity. But because of lengthy and difficult government procedures proper advantage is not taken from this situation.

Organizational changes

This matter cannot be treated in isolation from the whole supply and demand of the construction industry. This is not as important for industrial projects as it is for urban residential and commercial building projects. For example, the present process of development that is the

separation of site development from building construction has to be modified and replaced by a system which would undertake the development of whole area including site preparation, infra-structure, etc. This pattern which is used in Karachi gives a clear indication that the economic attractions of such an arrangement are beginning to be accepted by both the buyers and suppliers of residential buildings. This process if used in other parts of the country will deliver good results.

Financial and credit problems

The financial problems of the industry continue to remain an obstacle to its progress. Every contractor faces difficulties in obtaining payments in time from the executing agencies. Delays occur mainly because of the differences between the contractor and the client on some aspect of work. Since matters remain pending and are not resolved in time, construction costs rise. This problem is more severe for contractors working for Public Works department and other government agencies. These organizations award contracts on scheduled rate basis which in most cases are lower and unrealistic. Contractors therefore try to make profit by producing sub-standard work. Since most

contractors find it difficult to get payment immediately after the completion of work because of differences or other reasons, they face lot of liquidity problems. It is also important to note that at present most of the construction firms face difficulty in obtaining loans from banks and financial institutions.

Contracting practices

Some aspects of this subject had already been discussed in chapter 5, and the problems faced by the buyer of the contracting services have been outlined. It has also been pointed out that contracts, particularly with the public sector agencies, are one sided, leaving the contractor at total mercy of the executing agencies. The more unreasonable are the conditions of the contract, the greater is the scope of corruption in the supervising department. In order to promote professional development of the industry, contracts based on equity should be framed.

Overseas business

Because of the increase in the construction activity in the Gulf and the Middle east, Pakistani firms

have secured a certain share of the business. Most of the firms face initial financing problems such as earnest money and performance bonds, etc. Pakistani banks are reluctant to provide assistance against the credit worthiness of those companies in Pakistan. There have been a few cases where larger firms have undertaken projects in collaboration with several medium and small sized firms with satisfactory results.

The following are some of the suggestions to encourage the firms operating overseas. They are :

* Relief in taxation from foreign earnings.
* Facilities to transport the equipment back to the country after the completion of the project.
* Liberal travel facilities for the management and technical personnel of the firms involved in overseas projects.

Research

A building research institute and a road research and material testing institute are located in Lahore. A combined institute was set up in 1946, but the road research institute was separated in 1962.

In case of buildings, a few ideas like large sized bricks, red tile roofing were developed but are not in commercial production yet. Most of the present research concerns different aggregates for cement blocks to replace bricks, problems relating to red tiles, foam concrete studies and temperature studies etc. In case of roads, the research primarily emphasizes materials testing and the design of road projects.

The research in these fields has been insignificant. Some efforts were made to solve the problems of low cost housing, but the progress has been very limited. The government should award more funds for research programs so that continuous effort is made to study engineering and economic solutions involving analysis of physical properties and cost techniques so that combinations can be developed to suit the existing conditions.

Material availability

Cement:

The government should give relaxations to investors and make policy changes to encourage the private sector to invest in cement factories, which in future years may solve the cement shortage problem.

If the current production rate remains and the construction rate continues to rise, acute problems may be predicted in the near future.

Bricks:

If brick production is to be expanded to keep pace with the projected demand, then coal (which is used for burning) may become a constraint during the next five years. Conversion to gas is advised to avoid this situation.

More mechanized system should be studied and implemented for increased production, improved quality and lower costs.

The cost of bricks is directly related to transport from the kiln to the site. Beyond a certain distance the additional cost of transport off-sets the cheaper price at which the bricks are produced. This means that economies of scale produced in larger kilns depends on the radius from the kiln.

Timber:

Timber shortage is likely to become more acute with the passage of time as domestic timber output is not able to keep pace with the growth in demand

for construction. Increased imports seem to be the only immediate possible solution. Another alternative is to go for rapidly growing trees such as poplar and euclyptus. Extensive plantations of such varieties should be taken up. It is not possible to use these woods directly for construction purposes, because of its inferior quality, but may be used for the manufacture of chip-board, plywood etc. In addition, certain quick growing and good quality wood generating trees can be imported and tried which may more or less solve the problem.

PVC Pipes:

The demand for PVC pipes is increasing rapidly as they are more economical compared to mild steel or galvanized iron pipes for domestic electricity and water supply. Present capacity, if maintained at a constant rate, will not meet the future demand. Setting up of additional units is essential for the coming years.

Asbestos Cement Pipes:

The demand for such pipes has grown at the rate of 11% during the last decade. Considering the demand

in construction this growth rate has to be increased and will not meet the construction requirement if maintained at the same pace.

The production of galvanized iron, cast iron, mild steel pipes and pre-stressed pipes is sufficient to meet the requirement of the construction industry and is in no serious problem.

Bitumen:

The demand for bitumen will depend on the construction of Indus Highway. If this project is not taken and postponed there will be no immediate shortage, otherwise production has to be increased to 200,000 tons per year to meet the requirement.

Aggregates:

There is no immediate problem but the capacity has to be increased taking into account future demands in construction.

Fuels:

The main fuels used by the construction industry are diesel and petrol for operating machinery and

transport equipment. (Coal and gas for brick burning). Besides coal other fuels do not pose any specific future problem.

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