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9. ABSTRACT
This is Volume 2 of a two volume set of papers presented at a conference in July 1970 and sponsored by the A.I.D. Bureau of Near East and South Asia to discuss employment problems of countries in those areas. The three fold purposes of the conference were: to compare notes with officials, researchers and academicians about the nature of the employment problems within the region; to encourage some analytical work into these problems and subject it to the scrutiny of researchers from different backgrounds; and to raise the level of concern for the unemployment problem among persons who might otherwise not be aware of the problem. Fifteen papers are presented in this volume on subjects including: the effects of tractors on farm output; the green revolution and agricultural development under conditions of rapid population growth in Pakistan; surplus labor in Turkish agriculture; prospects for increasing employment in Indian manufacturing, employment in Iranian industry; employment potential of roads; the effects on the labor force of Turkish workers going abroad; the problem of urban unemployment in Africa; employment and unemployment in Puerto Rico; and other similar employment and economic issues. An essay is included in Volume 1 which pulls together an integrated, comprehensive picture of the ideas and issues raised. The five main points discussed are: correcting price distortions; reallocating investments to favor sectors producing wage goods; emphasizing equity in the distribution of income, wealth, and economic opportunities; reversing the bias in technical research and develop-

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ment; and a comprehensive planning package including the generation of better employment opportunities.

EMPLOYMENT AND UNEMPLOYMENT PROBLEMS OF THE NEAR EAST AND SOUTH ASIA

VOL. II

EDITED BY
RONALD G. RIDKER
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FOREWORD

This volume of papers resulted from a conference that the Bureau of Near East and South Asia, of the U.S. Agency for International Development, sponsored to discuss employment problems of the countries within its perview. The purposes of this conference were three-fold: to compare notes with officials, researchers and academicians about the nature of the employment problems within the region (what we know, what we don't know; what is being, done what needs to be done), to encourage some analytical work into these problems and subject it to the scrutiny of researchers from different backgrounds, and, in general, to raise the level of concern for the unemployment problem among persons who may otherwise not have the time and energy to dig deeply into this particular set of problems.

With the kind invitation of the Royal Nepalese Government, the conference was held in Kathmandu, July 6-9, 1970, with nearly 50 persons in attendance. If we judge in terms of the quality of the papers, the level of discussion, the recommendations made, the obvious interest and intellectual excitement that at times were demonstrated, the conference was a clear success. But frankly, we found ourselves with an embarrassment of riches. The participants came with close to 30 papers and much to talk and argue out, far too much material for a three and a half day conference. As a consequence, and because of the high quality of the papers, it was generally agreed that our deliberations should be published in some convenient form. This volume is the result.

In organizing these materials, we have taken the liberty of deviating somewhat from the chronology of the conference. Instead of presenting the papers and a summary of the discussion on them in sequence, an essay that pulls together a more integrated, comprehensive picture of the ideas and issues raised was prepared by Ronald Ridker, who also served as overall editor for this volume. For the same reason, we have decided not to include the transcripts of the rapporteurs' final statements: as good as they are, they are not complete enough to serve the needs of the general

reader. We owe these four men - S. Selvaratnam, P.M.Visaria, Ahmad Kooros, and S.R.Bose - many thanks for their efforts, which served as the raw material for the summary piece that has been presented (though they cannot be held responsible for its content). In addition, as the conference participants will observe, Professor Ranis's introductory and concluding remarks have been pulled together into a single essay for presentation in this volume.

The reader will also note that three papers on employment problems outside of Asia have been included in this volume. The presentation and discussion of these papers at the conference were very useful in gaining a sense of proportions about more strictly Asian problems, and are reproduced here for the general reader with the same purpose in mind.

Though it goes without saying, it should perhaps be noted for the record that the views expressed by the authors are not necessarily endorsed by any of the other authors, let alone any of the organizations with which the participants are affiliated.

In addition to the authors and discussants, many others contributed to the success of this conference and to the development of this volume, too many for a complete listing. On top of the list must come Professors Benjamin Cohen (who unfortunately could not attend the conference) and Gustav Ranis who initiated contacts with many of the participants and suggested topics to them. Next must come all those in the Agency for International Development, but especially in the USAID Mission to Nepal, who took such good care of us before, during and after the conference, to the Royal Government of Nepal for their hospitality, and to the chairmen, discussants and rapporteurs for each session. We would also like to thank Rita Sehgal who took on the job of turning our various forms of English into a readable whole.

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THE EFFECTS OF TRACTORS ON FARM OUTPUT, INCOME AND EMPLOYMENT DURING THE INITIAL STAGES OF FARM MECHANIZATION IN AFGHANISTAN

Khairullah Dawlaty

I. Introduction
II. Findings
III. Conclusion
IV. Summary
V. References

I. INTRODUCTION

Many factors bear upon the manpower and employment situation in developing countries. In the agricultural sector, mechanization is known to have direct effects on manpower needs and employment opportunities. Almost by definition, mechanization is the replacement of human labor by machines. In addition to the effects of mechanization on agricultural employment, there are effects from the introduction of new crop and livestock varieties and new cultural practices, intensification, diversification, specialization, an increasing dependency on a marketing system, and many other factors directly related to agricultural development. Aside from the agricultural sector, but related to overall development, are the effects of urban migration, industrial development, education and national planning.

The major purpose of this paper is to report on the effects of partial mechanization in Afghanistan and examine its primary effects on manpower and employment. This paper will also attempt to identify the probable secondary effects of mechanization.

Afghanistan is in the very early stages of agricultural mechanization, as will be shown in the following paragraph. This provides an extremely valuable situation

and a somewhat rare opportunity to study the effects of mechanization at this stage.

Background:

Before tractors were imported into Afghanistan, an attempt to popularize imported oxen-drawn farm machinery was made with the help of an FAO expert in 1951. However, the French Agricultural Mission and Jangalak Factory have recently intorduced the "Polyculturel", an ox-drawn multi-purpose implement which shows promise. Tractors were imported in Afghanistan for the first time in 1954 by the government and by a private agency. During 1954-60, some 100 tractors were imported of which 40 were used on government farms and 60 on private farms.

In 1963, the Ministry of Agriculture imported 100, 48 HP, fourwheel, diesel tractors with some implements from the U.S.S.R. Thirty were reserved for use by the Ministry and 70 were sold by the Agriculture Bank to private farmers in the northern areas of the country. These tractors, with attachments, cost 206,000 afs ($4,120). An 8 per cent down payment was required and five-year credit instalments were provided with no interest charged.

Following the importation of these tractors, a tractor station with two mobile workships was established. A training course for tractor drivers was mandatory. These tractors were sold to farmers who had at least 300 jeribs (60 hectares) in one lot or a few lots close to each other.

In July 1966 it seemed that the demand for tractors was high, as 265 applications for purchasing tractors were received. The Ministry of Agriculture negotiated the importation of another 100 tractors from the U.S.S.R. This time the down-payment was raised to 25 per cent and a 6 per cent interest was charged on the loan. In the same year, 200 British-made Massey Ferguson tractors were imported and sold to private owners in the central part

of Afghanistan. Further indication of farmer demand for tractors in evidenced by private importation of fifty tractors into Afghanistan. Information regarding the rate of interest and the down payment on government imported tractors is shown in Table 1.

Considerable changes have occurred in government attitudes and policies concerning agricultural mechanization in Afghanistan during the short history of partial farm mechanization. Upto the end of the First Five-Year Plan (1961), and during the beginning years of the Second Five-Year Plan, government policy was inclined toward the increase and expansion of farm mechanization. It was felt at that time that further mechanization would bring more land under cultivation, would increase crop yields, and the large farms in the less populated areas would gain more labor efficiency. This policy is still followed for expansion and popularization of water pumps, specifically in the central and western areas of the country. As for further importation and popularization of tractors in agriculture, the policy has gradually changed toward a limited, carefully planned mechanization program. A limited dimension for tractor use in the whole nation is advised by Ministry of Agriculture and government-related planning authorities. This is to control further farm labor displacement by tractors. It is also advised that tractor use should be facilitated on large private farms, especially in the areas which have farms large enough to provide an efficient use of tractors.

It appears that during the same period tractor utilization has come under careful scrutiny by government planners. A reason for suggesting a restricted tractor program by the government could be that they feel that a further facilitation of labor mobility and the creation of new private farms cultivated by traditional methods will be a more efficient way of land exploitation.

Partial mechanization and full mechanization are relative terms used to describe the level of machine involvement in various phases of farm production operations. Full mechanization is descriptive of highly

TABLE 1

GOVERNMENT IMPORT AND DISPOSITION OF FARM TRACTORS

Afghanistan 1954-1966 and Projections 1970-72

Year	Number of Tractors Imported	Country Imported From	Number Used by the Government	Number Sold to Private Owners	Total Cost	Down-Payment	Interest Rate	Number of Installments
1954-60	100	-	60	40	-	-	-	-
1963	100	U.S.S.R.	30	70	206,000 afs	8%	0	5 years
1966	100	U.S.S.R.	0	100	264,265 afs	25%	6%	5 years
1966	200	U.K.	0	200	368,853 afs	25%	6%	5 years
Anticipated:								
1970	150	U.K. & U.S.S.R.	0	150	-	-	8%	5 years
1971	150		0	150	-	-	8%	5 years
1972	150		0	150	-	-	8%	5 years

mechanized farms where a relatively large amount of the total work is done by machines. Literally full mechanization, even in the highly industrialized countries, does not exist. The term partial mechanization is used to describe the current stage of farm mechanization in Afghanistan. Here, tractors perform only a few operations; man and animal power are still most important 1/ as tractors are not fully equipped with all major labor replacing implements.

Partial mechanization, from the standpoint of the nation's agriculture as a whole, would mean that only a very small percentage of farms are using tractors.

In April 1969 a study of the economics and utilization of tractors was undertaken by the Faculty of Agriculture at Kabul University at the request of Afghanistan's Agricultural Development Bank, the country's only agricultural credit institution. The Agriculture Development Bank has recently obtained a credit of five million dollars from the IBRD, part of which is to be used to finance the importation and sales of tractor and implements to farmers. The IBRD agreed to open negotiations subject to the proviso that IBRD funds could be used only for the purchase of items which were economically feasible and which would contribute to agricultural development.

Objective of Study:

The main objectives of the study were to:

1. Determine the characteristics of the farms on which tractors are being used.

2. Determine the characteristics of the farm operators who were among the first to purchase tractor

1/ Operations such as ditching, ridging, row planting cultivating, harvesting, threshing and clean up are performed by human or animal labor; irrigation is another labor consuming operation.

3. Determine the current use of tractors.

4. Determine the changes brought about on farms by the use of tractors with respect to:

a. area cultivated anually before and after tractor purchase;

b. volume of production before and after tractor purchase ;

c. volume of crop sales before and after tractor purchase;

d. annual net farm income after tractor purchase;

e. size and composition of the farm labor force;

f. number of oxen kept for farm power;

5. Determine farmers' attitudes, opinions and problems with respect to mechanization.

6. Draw some conclusions with regard to the technical and economic feasibility of tractors on Afghan farms.

Most of the data for this paper are taken from the study "Farm Tractors and Water Pumps in Afghanistan" by Dawlaty, Saunders and Owens, which was done for the Agricultural Bank in Afghanistan.

Method and Scope of Study:

The primary tool for gathering information for this study was personal interviews with tractor owners in the major tractor using areas of the country. A questionnaire was prepared and pre tested with tractor owners near Kabul. After revising the questionnaire, a random sample of 44 tractor owners, stratified by type of tractor and geographical location , was selected from a list of 400

tractors financed by the Agricultural Bank. Location or geographical stratification was done mainly to account for size and types of farms and kind of tractors. Of the total 400 tractors financed by the Agricultural Bank, 200 tractors were Beleyrus (Russian), mostly sold in the northern parts of the country, and 200 were Massey Ferguson, British-made, sold mostly in the central and southern parts of Afghanistan. An alternative sample was also drawn for use when owners selected in the main sample were not available for interview.

Fourteen tractor owners in the north 2/ and fourteen in the central 3/ parts of Afghanistan were interviewed by the author of this study, and the remaining 18 owners in the south 4/ were interviewed by a USAID Agriculture Credit Specialist and associates. The data were obtained from 44 successful interviews.

2/ Areas north of the Hind Kush mountain range, with a medium altitute ranging from 2,700 to 3,900 ft. from sea level. Areas near the Oxus river are less than 2,700 ft. in altitude. Average rain-fall is about 200 mm and the climate is temperate. The main source of irrigation water is from the rivers, soil is fertile, land areas are flat, almost no terraced farming exists. Major crops are wheat, barley, cotton, rice, oil seed, sugar beet and melons.

3/ Include the 3 south-central provinces of Afghanistan - Ghazni, Kabul and Paktia. Altitude ranges from 3,200 to 7,200 ft. Land areas which are mostly irrigated from the underground sources of water are limited; however, non-irrigated land situated in various velleys of this region is abundant. Dry-land wheat farming is prevalent in this region. This part of the country has a temperate climate with four distinct seasons of the year.

4/ Includes the southern provinces of Kandahar and Helmand, which are mostly below 2,700 ft. Climate is very warm in summer and mild in winter. Most agricultural land is in the Helmand and Arghandab river valleys. Wheat,corn, barley, pomegranates, grapes and other fruits are commonly grown.

After the data were tabulated in raw form, they were analyzed by various cross-tabulations to obtain the descriptive data and relationships.

Limitations of the Study:

During the interviews it appeared that most of the tractor owners were suspicious of the objectives of the study. Tractor owners were fearful of possible tax increases or bank inspection. Therefore, the owners were thought to be slightly upward biased in estimating some of their costs, and in some instances may have given a low estimate of their production and yields. Because of the shortage of time, bad roads, and difficulty in locating owners and their homes or farms, the shift from the main sample to the alternate sample was more than expected.

II. FINDINGS

Description of Farms:

Wheat (irrigated and dryland), cotton, corn, barley and forage were the most important crops grown on the farms where tractors were used (Table 2).

Diversification of crops was one of the common characteristics of these farms. Variation existed in the extent of diversification and in the emphasis placed on various crops. In the north, irrigated wheat was by far the most important crop followed by cotton, barley, corn, oil seeds and melons, in order of decreasing importance. In the central area where the major source of irrigation water is underground water, more than 70 per cent of the farm land on which tractors were used was for dry-land wheat. Irrigated wheat was the second most important crop , followed by forage, oil seeds, melons and some vegetables. Cotton is not grown at all in central Afghanistan.

Tractors used in the south were mostly in the Helmand and Arghandab irrigation project areas. In this area

about 75 per cent of the land area of the tractor-operated farms was used for growing irrigated wheat. Tractors were not used for dry-land wheat growing at all since there is no dry-land farming in the south. Other important crops were corn, cotton, barley, forage and some vegetables.

The Cadastral survey of land holdings is not completed in Afghanistan and tenure information for any part of the country is not available. Some agronomic and economic studies of farms in the north, central and eastern parts of Afghanistan indicate that there is a great deal of variation in the size of holdings in Afghanistan. Size of holdings ranges from as small as $\frac{1}{4}$ of a jerib to thousands of jeribs. For example, average size of selected farms in six eastern provinces is 6 jeribs. It is 56 jeribs in 5 northern provinces, and 19 jeribs in the Kohdaman Valley near Kabul, according to results from authoritative samples.

A Russian report indicates that 50 per cent of all farmland in Afghanistan is owned by 0.2 per cent of all landowners. A survey of 100 grape farms in the Kohdaman Valley, central Afghanistan, shows that 56 per cent of the farmland is owned by 5 per cent of the landowners. A survey of cotton farms in Kunduz shows that 62 per cent of the land is owned by 14 per cent of the landowners.

Tractor owners were usually large landholders. The average land area per tractor for all crops on which tractors were used in the north was 454 jeribs. It was 760 jeribs in the central areas, and 507 jeribs in the south. The average area per tractor for all tractor operated farms in Afghanistan was 560 jeribs (Table 2). These farms, although large enough for mechanization, cannot be categorized as truly commercial farms. This is mainly because they are not highly responsive to market forces as far as decisions about what to grow, how much, etc., are concerned. These farmers could be called commercial farmers inasmuch as they are selling part of their traditionally grown staple food crops and their

TABLE 2

USE OF TRACTORS FOR VARIOUS TYPES OF CROPS

44 Private Farms, Afghanistan, 1969

Crop	Owned Land (Jeribs)	Other** Land (Jeribs)	Average number of Jeribs operated per Tractor	Per cent of Total Cultivated Area
Irrigated Wheat	213.8	30.9	244.7	43.7
Dryland Wheat	87.5	84.1	171.6	30.7
Cotton	25.2	0	35.6	6.4
Corn	22.0	0	22.0	3.9
Barley	13.9	0	13.9	2.5
Clover & Alfalfa	14.3	4	14.7	2.6
Oilseeds	8.1	0	8.1	1.4
Melons	5.8	0	5.8	1.0
Mung Beans	5.8	0	3.9	.7
Other	18.7	20.9	39.6	7.1
TOTAL	413.1	146.7	559.8	100.0

* One jerib equal ½ acre
** Rented and Custom work

cash-crops. Farmers in the north and south are growing cotton as a major commercial crop, which is programmed and purchased by the government.

Tractor owners were found to be of a high economic status. Their occupations varied from full-time farm operators to village chiefs partially involved with farm work, merchants or shopkeepers and government officials whose land is rented out or let to share-croppers. The number of tractor owners who were tractor operators as well and the number of absentee landowners who owned tractors were few.

The importance of the use of chemical fertilizer, pesticides and improved seeds was realized by most of the tractor owners. Some of the farmers, particularly in the areas where irrigation water is limited, were also aware of the fact that chemical fertilizers will not increase yields and in some cases will even damage their crops when moisture is insufficient. Most farmers realized the need for improving their farming operation in order to increase their farm income. The major problems of the tractor owners with respect to mechanization were inadequate parts and repair service. Owners had to travel long distances to obtain parts, and they complained of high prices. Major repair shops are located in the large cities. Tractors were driven even for a minor repair service to these distant workshops. The difficulty in obtaining fuel was another problem faced by the owners. In most cases, improved seeds and chemical fertilizers were seen as the greatest necessity for improving farming operations. About 36 per cent of the farmers interviewed mentioned this point.

The Farm labor force falls into four main categories: (1) Ejaradar (renter); (2) Dehqan (share-cropper); (3) Mazdore (full-time laborer); and (4) Ojurakar (part-time laborer) Ejaradars (renters) take the land from the landlord by either paying a certain amount of grain per unit of land or a fixed amount of cash per unit of land. They are independent in making the decisions related to their farm operations. They supply all farm equipment, seeds, fertilizers and other inputs.

Dehqans (share-cropper) receive a certain share of all farm products. The share depends on the size of farm, quality of land and type of farming and on who supplies how much of the farm equipment. Generally speaking, landlords supply the oxen, equipment, seeds and fertilizers. However, this relationship varies in different parts of the country.

Mazdores (full time laborers) are hired persons paid a fixed amount of cash or grain plus food and lodging for the whole growing season or may be for the entire year.

Ojurakars (part-time laborer) are hired laborers who are given a daily wage in cash or grain. They are hired during the growing season or harvest season or whenever additional man-power is needed.

Utilization of Tractors:

Most of the tractors included in this study were purchased during 1966 and 1967. The average age of tractors was 17 months, with a range from 6-36 months (Table 3).

The total number of hours that the tractors had been used ranged from 1,000 to 5,500 with an average of 2,098. The average number of hours used per month was 132, which is a relatively high rate of usage by U.S. standards. The average number of days that tractors were idle per year was found to be 141, and ranged from 60-285 days. Tractors were used from 8-18 hours per day during the busy seasons.

Plowing tractors were used for planting operations. This operation is performed by pulling a wooden board (malah) behind the disk or field-cultivator to cover up the seed previously spread by hand. In this way the planting operation and soil softening operations are performed at the same time.

The average number of days that tractors were used per year for all operations was 170.5 (This information with operational and seasonal breakdown is shown in Tables 4 and 5).

TABLE 3

AMOUNT OF USE MADE OF TRACTORS

44 Private Farms, Afghanistan 1969

	Average	Range
Number of months used (age of tractor)	17	6-36
Number of hours used (since purchase)	2,096	1,000-5,500
Hours Used per month	132	58-292
Hours used per day(during busy season)	11	8-18
Number of days idle per year	141	60-285

TABLE 4

USE OF TRACTORS IN PERFORMING VARIOUS FARM OPERATIONS

44 Private Farms, Afghanistan, 1969

Operations	Average Number of Days Used Per Year	Per cent of use
Ploughing	70.9	42.0
Planting	2.4	1.4
Cultivating	15.5	9.0
Discing	14.2	8.0
Threshing	10.8	6.0
Hauling	33.4	20.0
Custom Work	10.0	6.0
Land Leveling	13.3	8.0
TOTAL	170.5	100.00

TABLE 5

SEASONAL USE OF TRACTORS

44 Private Farms, Afghanistan, 1969

	Average Number of Days Used	Per cent of Total
Spring	45.7	27.0
Summer	50.4	29.0
Fall	64.2	38.0
Winter	10.2	6.0
TOTAL	170.5	100.0

Tractors were less used for custom work in the south than in the Northern and central areas. The average

number of days per year that they were used for custom work was 13 in the north, 16 in the centre, and 4 in the south. Overall the average was 10 days of custom work per year per tractor.

The average rates charged for custom work per hour were 174, 170 and 168 afghanis, respectively, for plowing, cultivating and disking operations.

As mentioned before the number of days the tractors were used in farming was 170.5 days. This plus the average number of days the tractors remained Idle (141 days) is equal to 311.5 days. The remaining 53.5 days per year were not reported. It appears that a considerable amount of tractor time per year is wasted due to driving the tractors to the repair shops and for non-farm transportation.

The average number of fields in each of the holdings operated by tractors was 7 in the north and 12 in the central areas. This information was not obtained in the south. The average of the largest fields in the tractor operated holdings was 225 jeribs. The smallest was 3 jeribs. The average field size for all tractor-operated farms was 49 jeribs. This is a suitable field size for tractor use. Some of the fields were far apart. Small fields that are close to each other could easily be enlarged, especially in the north and south. In the central areas of Afghanistan where terraced farming exists, 93 per cent of the tractor time for land leveling was used for leveling old terraced farms or leveling and preparing new land. This large percentage in the central area indicates that there is a tendency toward integrating small fields into large fields suitable for tractors.

Effects of Tractors:

Area Cultivated - Table 7 contains information on the average amount of irrigated and dry-land area per farm before and after tractors were purchased. Total owned irrigated area per farm increased by 92 per cent while owned dry-land area decreased by 54 per cent. This change was found to be due to coverting more dry-land areas into

irrigated land. The big shift from dry land to irrigated land, especially in the central areas is mainly due to the use of tractors to prepare more land for irrigation in the previously used dry-land areas, availability of more irrigation water due to water pumps, timely planting and so on. Irrigated land per farm in the central areas increased from 404 jerib to 860 jeribs (+ 113 per cent), while the dry-land area decreased from 770 to 390 jeribs (- 49 per cent).

Table 7 indicates that tractor owners converted most of their dry-land farms into irrigated land. Still they rented more dry-land farming area. Their rented dry-land farms increased from 32 jeribs per farm to 653 jeribs per farm. This increase is more noticeable in the north. In the south and central areas there was no report of any rented dry-land farming. Lack of labor and vast areas of land available for dry-land farming in the north is possibly responsible for this difference.

The distribution of farms according to the total number of jeribs planted annually, before and after the buying of the tractors, is shown in Table 8. It appears that tractors have considerably increased the area planted. The number of farms planting less than 200 jeribs has decreased by 65 per cent, while farms planting from 200 to 400 jeribs and those planting over 400 jeribs have increased by 15 per cent and 100 per cent, respectively.

Area Cultivated, Production and Yield - The use of tractors has increased total production by increasing the area of tillable land and raising the production per unit of land (of certain crops). Table 6 shows the changes in total jeribs cultivated and the total production and yield. The increase in the yield of certain crops is due to the improving effect of tractors on soil, physical conditions and plowing and planting at the appropriate time. A reduction in the yield of beans and peas, forage crops and oil seeds is due to the fact that they are planted mostly

on large areas of newly reclaimed land of the tractor-operated farms, either for the purpose of soil improvement or for obtaining some minimum yield to cover some of the costs of land leveling and costs involved in water pump irrigation.

Quantity of Crops Sold - As shown in Table 9, increases in sales occurred for all agricultural products grown on tractor-operated farms. In the central area, increases in sales of clover and alfalfa were very high. This is due to the fact that about 42 per cent of the total land area on which tractors were used was planted with alfalfa and clover. This was done to improve the soil of the newly reclaimed land in this area and to exploit the underground water made available by the use of water pumps.

Sales of cotton grown in the north and south increased by 92 per cent, and the amount of melons sold as a cash crop increased from an average of 52 seers before tractor purchase to 395 seers after it.

Annual Net Farm Income - Table 10 is a summary of the economic benefit of tractors. The average benefit from tractor ownership was about 47,000 afs., without considering the earnings from custom work. If tractors are paid for ten hours per day for as average of 10 days of custom work per year at the average rate of 170.5 afs per hour, the average net benefit from tractor ownership should be valued at 64,049 afs per year per tractor when custom work is included.

A cost and return analysis of the three study regions (north, south central) showed that tractors were most profitable in the north (net income including earnings from custom work = 145,974 afs); quite economical in the south (net income including earnings from custom work = 85,028 afs), but uneconomical in the central area (net profit including earnings from custom work = 67,524 afs loss) primarily due to their high use in low return dry-land wheat farming. On the average, in this region

TABLE 6

CHANGES IN TOTAL AREA PLANTED, TOTAL OUTPUT AND YIELDS FOR VARIOUS CROPS

44 Private Farms, Afghanistan 1969

	Total Jeribs Cultivated		Per Cent	Total Production (Seers)		Per Cent	Yield		Per Cent
	Before	1347		Before	1347		Before	1347	
Wheat (Irr.)	5550	8818	59	129525	256592	98	23.3	29.1	25
Wheat (D.L.)	220	2934	1233	2230	24090	1429	10.1	11.6	15
Barley	258	368	43	4770	10486	120	18.5	28.5	54
Corn	200	681	240	5538	20067	371	27.7	28.3	38
Cotton	181	366	102	3135	9699	209	17.3	26.5	53
Mung Beans Chick Peas	74	255	245	1477	3079	108	20.0	12.1	-39
Clover & Alfalfa	134	473	263	6445	12135	88	49.6	27.7	-48
Oil Seed	83	270	225	720	2135	196	8.7	7.9	-9
Others*	103	282	272	6365	28530	348	61.5	101.0	65

* Crops such as Tobacco (produced mostly in the central areas), Vetch, Rice, Melons, Sorghums, Millets and Sugar Beet are included in this category.

TABLE 7

CHANGES IN AMOUNT OF LAND CULTIVATED AFTER TRACTOR PURCHASE

(Average number of jeribs per reporting farm)

	Before Tractor (1963-66)	After Tractor (1967-68)	% Change
Irrigated Land			
Owned	315	606	+92
Rented	0	15	-
Total	315	621	+97
Dry Land			
Owned	770	354	-54
Rented	32	653	+1941
Total	802	1007	
TOTAL (Irrigated & Dry land)	1117	1628	+46
Planted Annually			
Owned	354	547	+55
Rented	32	558	+1644
Total	386	1105	+186
Fallowed Annually			
Owned	230	319	+39
Rented	20	20	0
Total	250	339	+36

TABLE 8

DISTRIBUTION OF FARMS BY TOTAL NUMBER OF JERIBS* PLANTED ANNUALLY BEFORE AND AFTER TRACTOR PURCHASE

44 Private Farms, Afghanistan, 1969

Jeribs Planted Annually	Before Tractor	After Tractor	% Change
	(No. of farms)	(No. of farms)	
Less than 200	20	7	-65
200-399	13	15	+15
400 and over	11	22	+100
TOTAL	44	44	
Average	386	1105	+186
Range	8 - 3627	10 - 3612	

* One jerib equals approximately ½ acre

TABLE 9
CHANGES IN QUANTITIES OF CROPS SOLD
44 Private Farms, Afghanistan, 1969

	Average Quantity Sold Per Farm		Average Value Per Unit (afs)	Increased Sales	% Change in Quantity Sold	Change in Value (afs)
	Before the Tractor	After the Tractor				
	(Seers)					
Wheat	676	1,772	30	1096	+ 162	32,880
Barley	4	69	12	65	+1625	780
Corn	78	298	15	220	+ 282	3,300
Cotton	307	588	50	281	+ 92	14,050
Clover & Alfalfa	45	82	3	37	+ 82	111
Melons	52	395	6	343	+660	2,058
Oil Seeds	17	28	38	11	+ 65	418
Fruits	95	58	20	-37	- 39	-740
Mung Beans	19	42	40	23	+ 121	920
Others	140	291	10	251	+108	1,510
TOTAL	1,433	3,623		2,190	+154	55,187

TABLE 10

ESTIMATED ECONOMIC BENEFITS OF TRACTORS

44 Private Farms, Afghanistan, 1969

	Average Per Farm Per Year (afs)*
Benefits	
Value of additional production	133,753
Income from Custom work	17,050
Saving on oxen replaced:	
Maintenance	25,787
Depreciation	2,523
TOTAL	179,113
Tractor Costs	
Operating expenses	77,837
Depreciation	37,227
TOTAL	115,064
Net Benefit	64,049
Benefit/cost ratio	1.6

* Free market exchange rate: 75 afs per U.S. $ 1.00

71 per cent of the land on which tractors were used was planted with dry-land wheat, while the per cent of land planted with dry-land wheat was only 17 per cent in the north and 1 per cent in the south.

Size and Composition of Labor Force - The use of tractors at the current stage of mechanization has considerably effected the composition and pattern of the agricultural labor forces; however, the overall size of the labor force was not greatly effected.

The findings of this study on tractors and the farm labor force (Table 11) indicate that there was a 44 per cent reduction in the number of Ejaradars (renter or tenant groups) per farm after the purchase of tractors, while the number of Dehqans (share-cropper) and Mazdores (full-time laborer) increased 20 per cent and 10 per cent, respectively. Even though there was a net 7 per cent reduction in the total permanent labor force, the changes shown in the number of tenants required per farm appear to be mostly a shift from an independent group of tenants (Ejaradar) to less independent tenant groups such as Dehqan (share-copper) and Mazdore (full-time laborers) and Ojurakar (Part-time laborers). Such a change in the composition of the farm labor force is reflecting the social impact of farm mechanization during the initial stage. This is an important effect of partial mechanization, the ultimate consequence of which we can only speculate about.

Landlords who had previously rented out all or most parts of their land have become relatively more involved in their farms managerial affairs. In other words, after the purchase of tractors they have released most, or all, of their renters who are a more independent category of tenant and given their land mostly to the share-croppers who are working on a different basis and are less independent in their decisions.

The consequence of such a change could be a dual effect on production in the future. In the first place, a considerably large shift from an independent tenant to

tenants who are less independent in making decisions and who receive less profit would be likely to result in lower incentives to improve production. On the other hand, the increasing interest and further involvement of the big landlord in the process of farm decision-making is likely to direct him towards greater awareness of the major economic and market forces that effect farming and farm-production. This would, at the same time, attune him to making scientific decisions in regard to his farming operations.

TABLE 11

COMPOSITION AND SIZE OF FARM LABOR FORCE
BEFORE AND AFTER TRACTOR PURCHASE

44 Private Farms, Afghanistan, 1969

Type of Labor	Before	After	% Change
	(average number per farm)		
Tenants			
Ejaradar (Renters)	7.3	4.1	-44
Dehqan(Share-croppers)	7.0	8.7	+20
Full-Time Hired Laborers	2.7	3.0	+11
Total Permanent Labor Force	17.0	15.8	- 7
Part-time seasonal hired laborers	158	210	+33

The type of landlord who normally provides a certain amount of materials and supplies needed on the farm also provided the services of the tractors to his Dehqan (share-cropper) in this study. Results of the study on Dehqans' share in the north and central show that tractors have reduced the share of Dehqans by about 9 per cent in the north and 45 per cent in the centre area of the country. This information was not obtained from the south. The

percentage share of Dehqan tenants depends on the size of farm, productivity of the land, type of farming and on tenure arrangements (who supplies the various inputs). Tenants must receive at least a minimal living for their efforts; therefore, their percentage share is likely to be larger on the less productive land or, conversely, smaller on the more productive land, other factors being equal. The share of Dehqan tenants declined because tractors increased irrigated area and land productivity. Although this study made no attempt to measure the total amount received by tenants as their share, personal observations of the author, while conducting the field survey, indicate that the total amount received by Dehqan tenants actually increased even though their percentage share declined. This would be an important topic for further study.

The effect of the initial farm mechanization on the size and composition of the farm labor force was:

1. A closer involvement of the landlords in managerial activities and decision-making processes.

2. Planting larger portions of farmland than the area the landlord could plant before tractor purchase.

3. A shift from more independent tenants to tenants who are less independent.

4. A small amount (7 per cent) of the permanent labor force is replaced. The unreplaced labor force plus an increase (33 per cent) of part-time seasonally hired laborers are used for those farm operations that tractors are not equipped for, as a result of planting more land and as a result of changing more dry-land to irrigated land (Table 6 and 7). Dry-land wheat, which is not a labor intensive crop, requires 8.64 labor days per jeribs while irrigated wheat, a relatively labor intensive crop, requires 14.22 labor days per jerib 5/.

5/ K. Dawlaty, Z. Salen and Dr. P. Owens - Wheat Production

5. The joint effect of tractors and water pumps in the areas where water for irrigation is not abundant could also be counted as a factor resulting in the planting of more land per farm and a cause of the increased employment of more seasonal or part-time labor.

Information about the effect of tractors on the number of oxen is shown in Table 12. A total of 300 bullock (60 per cent) was replaced by tractors on all farms; the number of bullocks replaced per tractor was 3.8. Oxen power is still used on small fields that are located far apart, with barriers making tractor use difficult.

TABLE 12

NUMBER OF BULLOCKS(OXEN) BEFORE AND AFTER TRACTOR PURCHASE

44 Private Farms, Afghanistan, 1969

	Before	After	Average No. Repalced by Tractor	% Change
Number of farms	44	44	-	-
Total number of bullocks	491	191	300	-61
Average number of bullocks per farm	11.2	4.4	6.8	-60

III. CONCLUSION

During the early stages of agricultural mechanization in Afghanistan, the actual amount of human labor replaced by machines is relatively small. Even though one tractor and one driver can do the work of many men (and

in Afghanistan Cost of Production and Returns - Technical Bulletin No.17, Faculty of Agriculture, Kabul University.

oxen) for certain farming operations, this same tractor increases the need for human labor in several other ways:

1. It was found that tractor use increased cultivable land area, particularly in the irrigated areas. Because mechanization is only in its initial stages, and does not include such machines as combines, mowers, land levellers, and because there is very little mechanized irrigation, the need for human labor is increased.

2. Tractor use resulted in increased crop yields in most instances. This increases the need for human labor in operations which are not currently done by tractors (such as harvesting and threshing of food grains).

3. Tractor use sometimes resulted in shifts from labor extensive to labor intensive crops.

4. Some farmers diversified their farm operation as a result of increased farm size to include more labor intensive enterprises.

Perhaps even more important, partial mechanization causes shifts in tenure patterns which may have varied effects on employment patterns and manpower needs as well as on production and sales. The shift from "independent" (Ejaradar) tenants to tenants who are less involved in decision-making (and profits) is likely to result in lower incentives to produce. On the other hand, the large landholders who own tractors are more likely to become attuned to scientific decision-making and more aware of economic and market forces.

In the hired labor category, there is a noticeable increase in the use of full-time labor. The manifestations of this change will not be fully understood until more is known about seasonal labor requirements in the various geographical areas of Afghanistan, and areas of labor shortage and surplus. It is quite possible that some of the displaced tenants become farm laborers. These shifts are shown in Table 11.

The significant reduction in work animals brought about by tractor use causes a decrease in forage requirements. This could allow a shift to commercial crops and/or could provide an increase in the food available for other types of livestock.

The increased production (from the greater area planted and higher yields) will result in more sales.

It seems logical at this point to assume that future mechanization will replace labor at an increasing rate. This is because additional land for reclamation and irrigation water will become scarcer and future mechanization will include such machines as combines which tend to replace more labor than do tractors and simple implements. At least part of the labor replaced by machines will contribute to the currently noticeable rural-urban migration. Increased sales will be used to sustain the growing urban population and to provide raw material to industries which, hopefully, will employ them.

The increased sales and growing needs for agricultural inputs which cannot be produced on the farm will exert pressures for expansion of the marketing system and the commercial sector in general. This should contribute to non-farm job opportunities.

Hopefully, mechanization, agricultural development, industrialization, education and commercial development in Afghanistan will proceed in balance to prevent widespread unemployment.

IV. SUMMARY

There are only about 450 or 500 tractors in Afghanistan, but these tractors are used intensively. Plowing is their most important use. They are also used a great deal for hauling. Returns from tractor use on dry-land farms are low.

In the early stages of partial mechanization covered by this study, tractors did not replace human labor signi-

ficantly. They did, however, cause significant shifts in tenancy arrangements and hired labor patterns. Dehqan tenants (who furnish little more than labor in the tenancy arrangements) gained at the expense of Ejardar tenants who privide inputs such as seed, oxen, labor and are more involved in decision-making. Hired labor increased on farms with tractors, but part time labor increased three times more than full-time labor. Tractors replaced oxen (animal power) very significantly.

Tractor usage resulted in significant increases in area cultivated, total production and in sales of agricultural products.

Benefits from tractor use (value of additional production plus savings on oxen replaced plus income from custom work less total tractor costs) were about 64,000 afs (or $850) per year for all tractors. Benefits were highest in Northern Afghanistan where agriculture is most intensive (145,974 afs per year), lower in Southern Afghanistan (85,028 afs. per year) and negative in Central Afghanistan where tractors are used a good deal on dry-land acreage (-67,524 afs. per year).

The following table summarizes the major findings of this study:

Summary of Key Findings:

Utilization	Overall Average
Hours Used Per Month	132
Per cent of Use for Plowing	42
Per cent of Use for Hauling	20
Per cent of Use on Irrigated Wheat	44
Per cent of Use on Dry-Land Wheat	31
Costs	
Original Cost of Byelarus Tractors (afs)	311,829
Original Cost of Massey Ferguson Tractor (afs)	435,247

	Overall Average
Estimated Useful Life (years)	9-10
Annual Depreciation - (afs)	27,000
Annual Depreciation - Massey Ferguson (afs)	42,000
Annual Operating Costs (afs)	80,000
Annual Operating Costs - Massey Ferguson(afs)	100,000
Rates for Custom Work (afs per hour)	170

Effects of Tractors on Production

Percent change in area cultivated annually	+186
Percent change in annual Output of Major Crops:	
Irrigated Wheat	+98
Dry-Land Wheat	+1,429
Barley	+120
Corn	+371
Cotton	+209
Oil Seeds	+348

Effects of Tractors on Sales

Per cent change in crop sales:	
Wheat (irrigated and dry land)	+162
Corn	+282
Cotton	+92
Cloves and Alfalfa	+82
Oil Seeds	+65
Melon and Watermelon	+660
Mung Beans	+121

Effects of Tractors on Farm Labor Force

Per cent change in number of:	
Total permanent farm workers	-7
Ejardar (Renter) Tenants	-44
Dehqan (share-cropper) Tenants	+20
Full-time Hired Laborers	+11
Part-time Hired Laborers	+33

Effects of Tractor on Animal Power Requirements

Per cent change in number of Bullocks	-60

Benefits

Value of Additional Output Per Farm Per Year (afs)	133,753
Savings on Oxen Maintenance and Depreciation per Farm per Year (afs)	28,310
Income from Custom Work	17,050
Total Benefit Per Farm Per Year (afs)	179,113
Less Total Tractor Cost Per Farm Per Year (afs)	115,064
Net Benefit Per Farm Per Year (afs)	64,049

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THE EFFECT OF TECHNOLOGY ON FARM EMPLOYMENT IN TWO INDIAN STATES

(Punjab and Maharashtra)

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Martin H. Billings

I. Introduction
II. Methodology
III. Background
IV. Results and Interpretation
V. Energy Supply
VI. Summary and Implications
VII. Appendix
VIII. References

I. INTRODUCTION

Since 1966, the new high-yielding varieties of wheat, paddy, maize, bajra (millet), and jowar (sorghum), which are highly responsive to heavier application of fertilizers, regular and adequate supply of irrigation water, and good farm management prices, have provided a great incentive to mechanization of some farm operations in India. Pump sets, threshers, tractors and other mechanical inputs have rapidly gained popularity with the farmers.

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* The views expressed in this paper are personal and do not necessarily reflect those of the USAID Mission. Comments from Dr. Russell O. Olson, Dr. W.E. Hendrix and Dr. Ronald G. Ridker were most helpful in preparing this paper. However, the usual disclaimers apply.

The demand for mechanical innovations follows from the desire to escape from very high seasonal wages, which in Punjab reflect a critical scarcity of, and dependancy on, labour supply at harvest time and weather conditions to perform operations in time and with efficiency. Finally, machinery gives promise of greater cropping intensity than possible with animal draft. The direct effect of mechanization in respect of a single operation or a crop is thus that of saving labour. The scope it offers for multiple cropping and growing labour-intensive crops, and thereby bringing about increase in the total labour demand for all crops in a year, is often over-looked. The study attempts to infer the influence of technical changes in farm production upon the employment of the agricultural labour force over the period 1969-84.

The tendency of farmers to go in for farm mechanization has elicited sharp reactions. Those in its favour assert that farm mechanization is an essential ingredient of the 'Green Revolution' as the full potentialities of HYV can not be realized with traditional methods of farming and sources of energy. Others view employment as the major problem in this country because of the rapidly growing population. They fear that mechanization will cause displacement of agricultural workers, particularly of the landless labourers, which is likely to have repercussions among the rural socio-economic groups. In such a context, proposals recommending fundamental changes in the labour intensity of techniques require thoughtful consideration.

Farm mechanization in India has just started; it is still in its infancy. It has a long way to go before complete mechanization, as commonly understood in the Western countries, becomes widespread in the farm economy of any part of India. It is only in some areas that mechanization of a few selected operations such as ploughing, harrowing, sowing, pumping and threshing has started and even this is restricted to a few crops. The other operations like transplanting of rice seedlings, hoeing, weeding, harvesting, cotton picking etc., which are highly labour-intensive, are still carried out with traditional human labour. Thus, mechanization in this

country implies only partial mechanization or mechanization of a few selected important operations.

The traditional technology mainly makes use of human labour and, by and large, combines limited capital with abundant labour. HYV with associated inputs and multiple cropping are labour-intensive. In the expansion of areas under HYV and the adoption of intensive farm practices, the question that arises is whether the available labour force and technology could become a constraint in achieving the planned targets. To what extent will mechanization of selected farm operations displace farm labour? Which groups of farm workers (family labour or hired hands) and scales of operation will be affected by the new technology? There are a host of issues allied to these basic questions, the study of which is of vital importance. In this paper we will deal only with the effect of new technology on the employment of human labour in the states of Punjab 1/ and Maharashtra. Since the economic structure of the agricultural economy, excercising influence on the character of the problem, is widely different in the two states, it is more or less a study of two situations which are met with in extensive areas of northern and western India.

II. METHODOLOGY

The basic approach used in this study is to attempt a measurement of the potential impact of HYV and other important technological changes on farm employment by a simple physical projection model based on economic relationships thought to be relevant.2/

Our data have three basic components: demographic, technological and economic. While demographic data have been used for estimating the trend in farm working population and the supply of human energy in the perspective

1/ 'Punjab' denotes the territory of erstwhile Punjab, which now forms the successor states of Punjab and Haryana.

2/ This model has been developed as a part of a series of studies into farm mechanization in six states of India. See also M.H. Billings and Arjan Singh, "Labour and the Green Revolution", Economic and Political Weekly, Vol. IV, No.52, Review of Agriculture, December 1969.

period, the technology and economic information has been made use of in projecting the cropping pattern, demand for human energy, rates of adoption of technological changes and labour-machine displacement. The method employed is given in the Appendix.

The model accepts and makes use of a rather wide variety of data, which are often of a general, and even of a questionable, nature. Our crop projections, areas irrigated, crop intensities, labour requirements of crops, demand and supply of labour force, rates of adoption of new technologies and their impact on labour demand, represent 'best estimates' on our part, based on the statistical data available and information gathered from persons close to the subject. These factors may cause lack of precision, but we do not feel this will effect our conclusions, as our essential objective is to indicate direction. To the extent our model provides a reasonable picture of the movement in supply and demand for energy, as technical changes occur over the crop years and the degree to which conventional and other energies become a constraint, we believe the work serves the purpose. Fundamentally, for our analysis, we are interested in relative levels and not in absolutes.

III. BACKGROUND

In view of widely different agro-economic conditions, it seems necessary to give here briefly the background information and the impact which new technological changes are making on the farm economy of each state.

Punjab:

Punjab is one of the leading agricultural states in India. Exclusive of hill areas transferred to Himachal Pradesh on November 1, 1966, the State is rather a flat alluvial plain. Although rainfall in the Punjab plains is not so high as to be adequate for bringing crops to maturity, the State is well served by snow fed rivers and perennial canals and endowed with easily tappable sub-soil water for irrigation. The Punjab soils are deep, fertile and highly productive. There are two main harvests, one sown in

October-November and harvested in March-April, and the other planted in July-August and gathered in October-November. About two-thirds of the cropped area is devoted to foodgrain crops, the most important of which is wheat, accounting for as much area as under all other foodgrain crops put together.3/ Cattle feed and miscellaneous crops account for another 20 per cent of the cropped area. Among the important non-food crops are cotton (6 per cent) and sugar-cane, rape and mustard, and groundnut, each nearly 3 per cent.

The Punjab state had a total population of about 20 million persons in 1961, of which about 20 per cent lived in urban areas and 80 per cent in villages. About two-third of the population depends upon agriculture for their livelihood. Punjab has the lowest female/male ratio amongst various states in India. About 35 per cent of the population is in the work force, of which 63.4 per cent is engaged in agriculture. Amongst the farm workers, women participated to the extent of 23.5 per cent. Agricultural labourers constituted 12 per cent of the total farm force in 1961 as compared with 17 per cent in 1951. Their number is showing a sharp decline, particularly of women workers, whose proportion amongst agricultural labourers fell from about 33 per cent in 1951 to 11 per cent in 1961 (1,5).

Punjab is a land of peasant proprietors; 52 per cent of the cultivators work entirely on their own lands, another 34 per cent augment their own holdings with rented land and only 14 per cent of the households are purely tenants. An average operational holding is about 12 acres. Nearly 60 per cent of the cultivating households operate farms larger than 7.5 acres and only 12 per cent operate farms smaller than 2.5 acres. Although 63.2 per cent of the holdings are less than 12.5 acres each, the area operated by them is only 28.8 per cent of the total cultivated area. In the holdings of larger sizes the proportion of households decreases, but the area operated increases, in as much as 8.9 per cent of the households having 30 acres or more each operate 29.3 per cent of the total cultivated area (1,5).

3/ The staple diet of the people is wheat, supplemented with maize in central districts, rice in hilly areas, and millets and gram in the southern parts of the state.

The process of consolidation of scattered and fragmented small fields into larger units has progressed in the State to cover practically all of the farmed land. This feature is of special significance in Punjab agriculture as it has given a strong fillip to the extension of irrigated area, land improvement and introduction of new technology.

Notwithstanding the development of a few pronounced industrial centres, industrial units in the State are, by and large, small and agro-based. They are fairly well dispersed and have, thus, a healthy effect on agriculture and allied activities. The state is well served by road and railways.

Two agro-climatic environments in the Punjab provide relatively homogeneous and highly favourable conditions for widespread use of new HYV of foodgrains and for an associated increase in fertilizer consumption and other inputs. Since 1965, area under HYV has sharply risen, in several districts exceeding the planned targets. Wheat yields have doubled in the past 5 years, thus causing farm labour to be much more in demand than before and a sharp increase in the level of wages at harvest time. Farmers are responding to labour shortages and higher wage rates by substituting capital-intensive technology in critical activities, where they are heavily reliant upon non-family labour or where yield-increasing opportunities are dramatic. The HYV demand faster seed-bed preparation to gain full benefit from their shorter duration, and multiple cropping. In this context, the HYV are the thin edge of a wedge which will very likely lead to the progressive mechanization of agriculture, although their initial effect is labour intensive.

The HYV with fertilizers are an input which is largely neutral to scale, being highly divisible, and is a technology open to any farmer on rain-assured or irrigable acreage. To the extent to which water is available, the seed-fertilizer technology is open to farmers of all scales of activity, though small farmers will be late in adopting it.

The provision of intensive irrigation on the farm site, owned by a farmer, is a lumpier input and is related to scale. Very considerable effects on yields, intensity of

cropping, farm income and need for labour can be expected to follow from this transformation.

Mechanical wheat threshers introduced recently are being used in the state very extensively. These are produced locally, within a wide range of capacity and price, in practically every town of the State. Its economies are so clear (about 4-5 times as fast as the traditional system) that it is a question of only a few years before almost all wheat will be so processed. Since these machines are available in different sizes to suit farmers of different scales and custom service in threshing has become quite common in the State, this mechanical innovation could be regarded as neutral to scale.

Extra yields of HYV of wheat have caused April to be a difficult month for harvesting. Labour wages have reflected this and in some areas demand has outstripped supply even at high wage rates. A market for rapid mechanical reaping has consequently come into existence rather suddenly with the change in varieties, and some machines have already come on the market. A really suitable machine is yet to be developed, but by the latter part of the decade there is a reason to believe that such equipment will become commonly available and make an impact on production costs and the demand for labour. This machine is likely to be less neutral to scale than treshers. Yet as the machine becomes common, custom work will surely spread and the effect of the machine will be widely felt (1,3).

The tractor is a costly machine. Its supply is very much subject to public policy and its effect upon farmers and labour is conditioned by rather a wide set of policy and structural variables. In fact no other element in mechanization attracts the attention of so many persons, politicians, policy makers, economists, agronomists and engineers, as the tractor. It is the symbol of modern farming. In Punjab, tractor demand has sharply risen as a result of the seed-fertilizer revolution and high farm income. The supply, on the other hand, is inadequate but the State government is actively supporting local

manufacture and import of tractors to ease the situation.

In Punjab, tractors are owned largely by big farmers and even by medium farmers, holding 15 to 30 acres. They mostly make use of the tractors themselves, but some of them also use them off their farms as a source of extra income. Several factors will condition the amount of time a tractor-owner will be willing to rent out the machine for, the size of his own farm, the risk of wear from extra use in an area where service is a real problem, and his ability and readiness to make the necessary business arrangements to conduct custom operation. Some services, both plowing and transport, are being done at present. More services are likely to develop with increase in the number of tractors. But the rate of extension of custom service, especially from large farms, may be much slower than desirable for non-owners to be able to share in the benefits of tractor power. (1,3).

There were, in 1968, about 100,000 diesel and electric pump sets, 80,000 wheat threshers and 20,000 tractors in Punjab (1,3). Since then further increase has taken place, the figures for 1969 being 142,000, 100,000 and 22,349, respectively. These figures represent an increase of eleven times in pump sets and five times in tractors over the past 13 years. Wheat threshers have appeared only recently. Since 1964, when their number was estimated to be about 5,000, a nineteen-fold increase has occured. The motive behind this revolution appears to be the profit-seeking behaviour of the farmer, as anywhere else in the progressive areas of the world. The dominant explanatory variables in Punjab agriculture are high crop prices and high wage rates of the scarce and uncertain farm labour supply in critical periods.

Maharashtra:

The State of Maharashtra is largely an undulating plateau with a number of rivers and valleys. Its different parts show considerable variation in climate, rainfall, soil fertility and topography. Geologically the basic complex of the whole state is of volcanic origin with oceanic rock-formation along the coast. Black soils predominate in the

State, shading into red soils in its southern parts. By and large, both of these soils have poor depth and low level of fertility. On a vast tract, their productive capacity has progressively deteriorated as a result of unchecked erosion. Rainfall is low and highly variable. There are limited layers of aquifer in the sub-surface. Irrigation has, thus, not developed to a degree which could significantly mitigate the natural soil and climatic disadvantages. In fact, Maharashtra is one of the states in India having the lowest proportion of irrigated area - 8 per cent (16,20,21). Consequently the crop pattern of the State is dominated by jowar-bajra and such other low yielding and low-value crops. Of the gross cropped area of 19 million hectares, nearly 33 per cent is under jowar, 10 per cent under bajra and 12 per cent under pulses, all of which have rather lower productive potential than wheat and rice. These crops in the State are rainfed. A relatively higher proportion of area is under commercial crops, mostly cotton (14 per cent) and groundnut (10 per cent). Where perennial irrigation is available sugarcane is grown, but its area is less than one per cent of the cropped acreage (17).

In 1961-62 there were 3.6 million operational holdings in the State, operating an area of over 40 million acres. The average farm size works out to about 11.5 acres; however, 41.6 per cent of the holdings are in units of less than 5 acres. These 41.6 per cent of the holdings operate only 8.46 per cent of the agricultural land. At the other extreme are farms of 50 acres and above, which account for 8.90 per cent of the holdings but cultivate 36.78 per cent of the area (12).

As per 1961 census, Maharashtra had a total population of nearly 39.5 million, 28 per cent of which was urban and the rest rural. Nearly 48 per cent of the total population (19 million) were workers as against 35 per cent in Punjab. Cultivators and agricultural labourers account for 46.1 per cent and 23.8 per cent, respectively, of the total workers in the State. The participation rate of women workers is very high, being about 46 per cent amongst cultivators and 53 per cent among the agricultural labourers. The proportion of agricultural labourers to total farm workers is 34 per cent, which is nearly three times that in Punjab (7,17).

Industrially Maharashtra is considered as the most advanced state of India. The concentration of industries is, however, mainly in the Bombay-Poona regions and a few pockets of industrially developed areas of Kolhapur, Sholapur, Sangli and Nagpur (16). The rest of the state is predominantly agricultural, the distinctive feature of which is meagre and unreliable rainfall. The lack of adequate rainfall in most parts underlines the need for irrigation, but compared to Punjab the possibilities are both limited and expensive.

Nothwithstanding a relatively high degree of over-all urbanization and of larger opportunities of non-agricultural employment, the proportion of working force engaged in agriculture is high. Agriculture is the primary occupation of nearly 2/3rd of the working population. Because of localization of industries in a few areas, there is inequitable distribution of economic opportunities of off-farm employment in different parts of the State. In the predominantly agricultural regions, which occupy most of the State's area, very few people move from the orbit of agriculture and the rural community to the far off industrially developed centres. Movement to a distant city means complete uprooting and break with the family, neighbours and customs. In the absence of any nearby urban employment opportunities, farm workers tend to continue living in the rural areas.

Not much success has been achieved in Maharashtra in introducing hybrid varieties of crops. The area under HYV of jowar and bajra, the principal crops of the State, was less than 10 per cent in 1968-69 (24). More than half of the maize area was under hybrid varieties, but this crop is not of much importance in the State. It is not one of the staple diets of the people and is consumed by the rural population only as a last resort when jowar and bajra are scarce. HYV of paddy are grown in the irrigated area, but cultivators are accustomed, in this State, to a protective irrigation system, using irrigation water only in the event of the failure of rains. Tanks and seasonal rivers supply water when rainfall is adequate and thus, unlike Punjab, this source of irrigation water is mostly non-perennial. This results in difficulty in using intermittent assured irrigation which is essential for the successful growing of

HYV. Consequently this State cannot expect to attain levels of productivity comparable to the State of Punjab. Nevertheless crop pattern and yields on rain fed lands can be raised substantially above the present level by soil conservation and scientific dry-farming techniques. However, much will depend on the suitability of varieties to local conditions. In the case of jowar, which is the principal crop of the State, the recommended variety, CSH-1, is not finding much favour with farmers because of its susceptibility to shoot fly and its poor eating quality in comparison with local varieties.

The effect of four technological changes has been studied in Maharashtra. They are HYV, pump-sets, power threshers, and tractors. The other three innovations, corn shellers, power cane crushers and reapers, considered in Punjab, are not of much importance in the State. Maize occupies only a very minor position in cropping and the introduction of corn sheller will not bring about much saving in labour. Similar also is the case of power canecrushers, though for different reason. Most of the cane in this State is grown around the sugar factories, which utilize more than 60 per cent of the total cane produced in the State (16). It is estimated that about 1/3rd of total production is crushed with power cane crushers. Thus, already a bulk of the cane does not involve human and bullock labour in the process of its juice extraction. The replacement of traditional technology with diesel or electric power in the remaining 7 per cent of the cane by 1983-84 will hardly make any significant difference in the over-all labour requirements of the State. As for reapers, there is, at present, no visible indication of this machine gaining much ground in this State during the next 15 years, unless a cheap machine is evolved for cutting the staple jowar-bajra crops. Wheat reapers, unlike in Punjab, do not seem to offer much scope as the harvest of this crop in Maharashtra fails during the slack season.

Diesel and electric pump-sets are very popular in the State despite unfavourable conditions of pumping water from open wells and the limited area irrigated by each set (17,20). They are used extensively for lifting water from

rivers and streams (which flow with greatly varying discharges at different times of the year). The number of pumps is rapidly rising (up from 28,908 in 1956 to 326,348 in 1968-69) (19). The area irrigated by them is expected to increase from 27 per cent to 35 per cent in 1983-84.

Improved paddy threshers and machines for threshing wheat, jowar and bajra have appeared in Maharashtra recently. About 4,500 are now being used. By 1983-84, it is estimated that nearly 1/5th of the total area under paddy, wheat, jowar-bajra will be mechanically threshed.

Due to heavy soil conditions and unirrigated extensive farming, the demand in Maharashtra is for heavy wheeled tractors of over 30 horsepower. The number of such tractors, in 1968-69, was 4,500. Apart from these, there were 300 crawler tractors and 200 power tillers (16). The impact of such a small number of tractors on labour was very little. Heavy tractors are very costly and mainly owned by operators cultivating 20 hectares or more, or by the State government, or by sugar factories. However, the tractors owned by the State government render some custom service, apart from undertaking soil conservation work. The tractors with the sugar factories are also utilized for doing custom work on the cane growers' fields in the factory zones.

If we assume that only larger farms of 20 hectares or above will own wheeled tractors, the total number required will be about 90,000. For paddy areas the number of power tillers is estimated at 55,000 by taking a command area of each unit of 10 hectares. For 60 per cent of the sugarcane area, the number of crawler tractors of 50 hectares and above is estimated to be 2,000, assuming 40 hectares as the area operated by one unit(16). Judging from the past progress, however, it is estimated that by 1983-84 the State will probably have 45,000 wheeled tractors, 2,200 crawler tractors and 22,300 power-tillers, used over only 5.2 per cent of the total area.

IV. RESULTS AND INTERPRETATION

The estimates made of the impact of technical changes,

which are likely to materially affect the crop production func in the two states over the three plan periods, are given in Table 1. Each of the new technology inputs has a separate and distinct effect on the demand for human energy. For convenience, emphasis has been placed upon 1968-69 and the terminal year, 1983-84 (Table 2a, 2b(i) and 2b(ii)).

Punjab:

In Punjab high-yielding varieties of wheat have spread rapidly. Wheat threshers are being extensively used but cane crushers and corn shellers have so far made little impact. In 1968-69 pump-sets accounted for a quarter of the irrigated area and tractors were hardly a factor worth noting. The total effect of the selected non-conventional innovations was, thus, very small in the base year, being a 5.5 per cent decrease.

By themselves, the HYV increased the demand for human energy by 6 per cent, pump-sets reduced it by 4 per cent, threshers by a further 5 per cent and tractors by 3.5 per cent, such that overall demand was reduced by 12.5 per cent from the new peak level with HYV in 1968-69.

By 1983-84 farm machinery is expected to become a common feature in Punjab farm practices, when it seems possible that nearly 100 per cent of wheat will be mechanically threshed, 100 per cent of corn will be shelled by corn-shellers, 20 per cent of the gross cropped area tilled by tractors, 50 per cent of the wheat crop mechanically reaped and 60 per cent of the area will be irrigated by pump sets and tubewells (1,3). These changes from the conventional technology are feasible if no radical changes occur in public policy regarding mechanization and if relationships between farm costs and prices remain sufficiently favourable.

With the above changes in the methods of crop production, total human energy demand in 1983-84 in Punjab will be reduced from the conventional level by 17.4 per cent. The greatest displacement will occur in April and May when demand will fall by 25.4 per cent and 43.9 per cent respectively. April is the harvest period when labour is in

TABLE 1

ASSUMPTIONS USED IN CALCULATING THE EFFECTS OF TECHNOLOGICAL CHANGES ON AGRICULTURE IN PUNJAB AND MAHARASHTRA FROM 1968-69 TO 1983-84

(Proportion of Area Affected by Changes)

Item	Punjab		Maharashtra		Remarks
	1968-69	1983-84	1968-69	1983-84	
High yielding varieties					
Wheat: % of irrigated area	50	95	7	37	For Maharashtra percentages are of total area under respective crops as irrigated area in this case is small.
Paddy: " " "	20	80	9	60	
Hybrid maize: " "	15	60	50	90	
Hybrid bajra: " "	6	60	12	60	
Hybrid jowar: % of total area	--	--	9	30	
Irrigated areas					
Percentage of total cropped area	50	66	8	18	
Percentage of irrigated area by:					
i) pump sets	24	60	27	35	
ii) wells	22	4	41	17	
iii) canals, tanks etc.	54	36	32	48	
Power threshers					In Punjab Power Threshers are used only for wheat. In Maharashtra, for paddy, jowar-bajra and wheat.
Percentage of crop threshed	50	100	--	20	
Reapers					These figures are very speculative. While in Punjab reapers have appeared on the scene they are nowhere near yet in the predominantly millet areas.
Percentage of crop cut	--	50	--	--	
Tractors					
Percentage of area expected to be covered	3	20	.5	5	

NOTE: These figures represent approximate percentages of the areas in the projected crop patterns and have been worked out on the basis of estimates of the Planning Commission and State Governments.

TABLE 2a

CUMULATIVE CHANGES IN DEMAND FOR HUMAN ENERGY FROM CONVENTIONAL TECHNOLOGY THROUGH POSTULATED INCREMENTAL CHANGES* IN PUNJAB

(millions of man days)

	July	August	September	October	November	December	January	February	March	April	May	June	Total
1968-69													
Conventional.....(i)	50.21	38.73	54.40	100.46	68.55	30.36	40.34	24.62	32.98	68.04	65.42	34.54	608.65
(i) with HYV.....(ii)	51.25	39.75	52.30	95.19	81.59	37.66	42.88	26.15	30.34	76.34	75.31	35.56	844.34
(ii) with pump-sets.....(iii)	51.25	37.66	50.21	93.09	79.50	34.52	40.79	23.01	27.20	74.27	73.22	33.47	618.19
(iii) with wheat threshers. (iv)	51.25	37.66	50.21	93.09	79.50	34.52	40.79	23.01	27.20	74.27	41.84	33.47	586.81
(iv) with cane crushers.....(v)	51.25	37.66	50.21	93.09	79.50	33.47	39.75	21.96	26.15	74.27	41.84	33.47	582.62
(v) with corn shellers.....(vi)	51.25	37.66	50.21	92.05	78.45	33.47	39.75	21.96	26.15	74.27	41.84	33.47	580.53
(vi) with tractors.....(vii)	50.31	37.35	49.58	91.11	77.51	33.47	39.75	21.65	25.52	73.97	41.54	33.05	574.91
(vii) with reapers		Reaper not available on farms in this period, so no separate estimate is included.											
(i-vii) net change	+0.10	-1.38	-4.82	-9.35	+8.96	+3.11	-0.59	-2.97	-7.46	-5.93	-23.88	-1.39	-33.74
1983-84													
Conventional.....(i)	62.10	55.57	69.60	135.33	96.88	41.63	64.49	39.17	50.69	90.35	87.19	47.57	840.57
(i) with HYV.....(ii)	66.81	62.04	63.23	120.49	134.81	60.84	72.77	42.95	52.49	110.95	114.53	50.10	952.01
(ii) with pump-sets.....(iii)	64.42	56.07	56.07	113.34	126.46	53.68	63.23	34.60	42.95	106.18	108.56	41.75	867.31
(iii) with wheat treshers (iv)	64.42	56.07	56.07	113.34	126.46	53.68	63.23	34.60	42.95	100.18	52.53	41.75	805.28
(iv) with cane crushers....(v)	64.42	56.07	56.07	113.34	126.46	52.46	59.65	27.44	40.56	100.18	52.53	41.75	790.86
(v) with corn shellers....(vi)	64.42	56.07	56.07	100.21	120.49	52.49	59.65	27.44	40.56	100.18	52.53	41.75	771.86
(vi) with tractors.....(vii)	56.67	52.59	53.09	93.05	114.52	48.32	59.06	25.06	37.58	99.60	48.93	38.17	726.63
(vii) with reapers	56.67	52.59	52.09	93.05	114.52	48.32	59.06	25.06	37.58	67.38	48.93	38.17	694.41
(i-vii) net change	-5.43	-2.98	-16.51	-42.28	+27.64	+6.69	-5.43	-14.11	-13.11	-22.97	-38.26	-9.40	-146.16
% change 1968-69	-1.9	-3.6	-8.9	-9.3	+13.1	+10.2	-1.5	-12.1	-22.6	+8.7	-36.5	-4.0	-5.5
% change 1983-84	-8.7	-5.4	-23.7	-31.2	+18.2	+16.1	-8.4	-36.0	-25.9	-25.4	-43.9	-19.8	-17.4

* While HYV increase labour requirements of various operations by 20 per cent to 50 per cent, the trade-off in labour demand for various mechanical devices has been introduced at the following rates:
(a) pump-sets: rated at 1/4th of the man hours required with the persian wheel; (b) wheat thresher: rated at 1/4th of the man hours required with the indigenous method; (c) tractors: rated at 1/5th of the man hours required with bullock drawn implements; (d) reapers: rated at 1/5th of the man hours required with the traditional method; (e) corn shellers: 1/7th of the manual labour formerly required; (f) power cane crushers: at 1/5th of the manual labour required with indigenous method.

TABLE 2b (i)

CUMULATIVE CHANGES IN DEMAND FOR HUMAN ENERGY FROM CONVENTIONAL TECHNOLOGY THROUGH POSTULATED CHANGES* IN MAHARASHTRA (1968-69)

(million days)

	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March	April	May	June	Total
					(Man days)								
Conventional.....(i)	79.5	87.1	85.5	82.0	84.4	80.2	49.5	38.8	40.0	37.7	47.7	77.9	790.3
(i) with HYV.....(ii)	80.6	88.2	86.6	83.3	85.8	81.1	49.9	39.1	40.4	38.0	48.1	78.9	800.0
(ii) with pump-sets..(iii)	80.3	87.8	86.2	83.0	85.5	81.0	49.7	38.9	40.2	37.8	47.9	78.5	796.8
(iii) with tractors					Practically negligible.								
Net change	+0.8	+0.7	+0.7	+1.0	+1.1	+0.8	+0.2	+0.1	+0.2	+0.1	+0.2	+0.6	+6.5
					(Woman days)								
Conventional.....(i)	79.9	94.1	94.7	106.2	113.5	88.3	36.6	52.8	27.9	19.0	40.2	60.9	814.1
(i) with HYV.....(ii)	80.7	94.8	96.2	107.8	114.7	89.3	36.9	53.0	28.1	19.1	40.5	61.6	822.7
(ii) with pump-sets..(iii)	80.7	94.7	96.1	107.7	114.6	89.1	36.9	53.0	28.1	19.1	40.5	61.6	822.1
(iii) with tractors					Practically negligible.								
Net change	+0.8	+0.6	+1.4	+1.5	+1.1	+0.8	+0.3	+0.2	+0.2	+0.1	+0.3	+0.7	+8.0
					(Total human labour days)								
Conventional.....(i)	159.4	181.2	180.2	188.2	197.9	168.5	86.1	91.6	67.9	56.7	87.9	138.8	1604.4
(i) with HYV.....(ii)	161.3	183.0	182.8	191.1	200.5	170.4	86.8	92.1	68.5	57.1	88.6	140.5	1622.7
(ii) with pump-sets..(iii)	161.0	182.5	182.3	190.7	200.1	170.1	86.6	91.9	68.3	56.9	88.4	140.1	1618.9
(iii) with tractors					Practically negligible.								
Net change	+1.6	+1.3	+2.1	+2.5	+2.2	+1.6	+0.5	+0.3	+0.4	+0.2	+0.5	+1.3	+14.5
% change	+1.0	+0.7	+1.2	+1.3	+1.1	+0.9	+0.6	+0.3	+0.6	+0.4	+0.6	+0.9	+0.9

*While HYV increase labour requirerents of various crops by 20% to 35%, the trade-off in labour demand for pump-sets has been worked out at 1/6th of the time required with local water lift (mhote).

TABLE 2b (ii)

CUMULATIVE CHANGES IN DEMAND FOR HUMAN ENERGY FROM CONVENTIONAL TECHNOLOGY THROUGH POSTULATED CHANGES* IN MAHARASHTRA (1983-84)

(million days)

	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March	April	May	June	Total
					(Man days)								
Conventional.....(i)	91.4	97.3	99.1	90.8	93.6	90.0	60.1	42.5	44.2	40.3	53.8	89.8	892.9
(i) with HYV.....(ii)	97.3	103.6	105.1	97.8	101.7	96.1	62.4	44.3	45.7	42.1	56.6	95.4	948.1
(ii) with pump-sets.....(iii)	96.3	102.6	104.0	97.0	100.7	95.9	61.8	43.9	45.3	41.6	56.0	94.2	939.3
(iii) with power threshers(iv)	96.3	102.6	104.0	95.4	98.3	93.5	60.7	42.2	44.5	41.1	56.0	94.2	928.8
(iv) with tractors	93.3	100.3	103.0	94.5	97.9	93.2	59.2	41.6	43.9	39.8	54.4	90.9	912.5
Net change	+1.9	+3.5	+3.9	+3.7	+4.3	+3.2	-0.9	-0.9	-0.3	-0.5	+0.6	+1.1	+19.6
					(Woman days)								
Conventional.....(i)	87.3	99.9	106.4	121.1	131.5	97.1	38.2	49.3	31.3	20.8	42.4	66.8	892.1
(i) with HYV.....(ii)	92.4	105.1	114.0	129.2	139.7	103.1	39.9	50.6	31.9	21.9	44.6	70.5	942.9
(ii) with pump-sets.....(iii)	92.4	104.8	113.7	128.9	139.2	102.5	39.9	50.6	31.9	21.9	44.6	70.5	940.9
(iii) with power threshers(iv)	92.4	104.8	113.7	127.3	137.1	101.1	39.4	49.2	31.3	21.7	44.6	70.5	933.1
(iv) with tractors	90.9	104.5	113.4	126.3	136.8	101.0	39.2	49.1	30.9	21.4	44.0	68.9	926.4
Net change	+3.6	+4.6	+7.0	+5.2	+5.3	+3.9	+1.0	-0.2	-0.4	+0.6	+1.6	+2.1	+34.3
					(Total human labour days)								
Conventional.....(i)	178.7	197.2	205.5	211.9	225.1	187.1	98.3	91.8	75.5	61.1	96.2	156.6	1785.0
(i) with HYV.....(ii)	189.7	208.7	219.1	227.0	241.4	199.2	102.3	94.9	77.6	64.0	101.2	165.9	1891.0
(ii) with pump-sets.....(iii)	188.7	207.4	217.7	225.9	239.9	198.4	101.7	94.5	77.2	63.5	100.6	164.7	1880.2
(iii) with power threshers(iv)	188.7	207.4	217.7	222.7	235.4	194.6	100.1	91.4	75.8	62.8	100.6	164.7	1861.9
(iv) with tractors	184.2	205.3	216.4	220.8	234.7	194.2	98.4	90.7	74.8	61.2	98.4	159.8	1838.9
Net change	+5.5	+8.1	+10.9	+8.9	+9.6	+7.1	+0.1	-1.1	-0.7	+0.1	+2.2	+3.2	+53.9
% change	+3.1	+4.1	+5.3	+4.2	+4.3	+3.8	+0.1	-1.2	-0.9	+0.1	+2.3	+2.0	+3.0

*Trade-off introduced at the following rates:

(a) pump-sets: at 1/6th time required with local water lift

(b) power threshers: at 1/4th of the time required with indigenous method

(c) tractors: at 1/5th of the time required with bullock-drawn implements.

greater demand than at any other time of the year and there is a shortage of labour. Harvesting of 50 per cent of the wheat crop by mechanical reaper will displace nearly 32 million man days. Power threshers will reduce the demand for labour in May by 56 million man days. Tractors and pump-sets are seen to displace labour equally (6 per cent and 12 per cent) but their effect is spread rather evenly over the entire year. About 55 per cent of the total labour displaced is by tractors and pump-sets, 37 per cent by threshers and reapers, and the remaining 8 per cent by corn shellers and cane crushers (1,3).

Maharashtra:

Maharashtra presents an entirely different picture from that of Punjab. The new technological changes have hardly made much impact on its agriculture. The additional demand created for human labour by the HYV is rather small, but it is more than the counter-balancing effect of mechanical devices which displace labour. In 1968-69, while the HYV increased the demand by 1.3 per cent pump-sets, the only factor considered, reduced it from the level attained with HYV by 0.2 per cent. The net increase amounted to 0.9 per cent.

By 1983-84, it is estimated nearly 1/5th of wheat, paddy, jowar and bajra will be mechanically threshed, 5 per cent of the area will be tilled by tractors and 35 per cent of the irrigated area will be using pump-sets. These changes will bring about an overall net increase in demand of 3.0 per cent. The busiest month in this State is November. Demand for labour in this month will go up by 4.3 per cent. The greatest increase (5.3 per cent) will, however, take place in September followed by November (4.3 per cent). An increase in demand is also recorded in June-July, the sowing period for summer crops. Practically no change will take place in January, but in February and March the demand for labour, as a result of the use of pump-sets, power threshers and tractors, will go down by 1.2 per cent and 0.9 per cent, respectively. By the end of the study period, with the change in acreage under HYV, demand for labour will increase by about 106

million human labour days or by 5.9 per cent. Pump-sets will displace 0.5 per cent labour and power threshers and tractors 0.9 per cent and 1.2 per cent, respectively. The net result will be an over-all increase in labour demand to the extent of 54 million human labour days, or by 3 per cent.

V. ENERGY SUPPLY

An estimate of human energy, cropped area, and agricultural workers over the projected years has been given in Table 3.

It will be observed that during the period 1951-61, the cropped area in Punjab increased by about 21 per cent, while the recorded increase in farm workers was only 11 per cent, with the result that the average number of workers per hectare declined from .51 to .47. The ratio apparently appears to be quite stable in the .46 to .48 range up to 1978-79, after which it shows a decline to .45. During the period studied, 1968-69 to 1983-84, the cropped area is expected to increase by 14 per cent and the number of workers by 10 per cent, reflecting a decrease of workers per hectare from .46 to .45. The year 1978-79 appears to be the turning point when the absolute number of agricultural workers will start showing a decline.

In Maharashtra the density of cultivators and agricultural workers per hectare of cropped area is much higher than in Punjab and is rapidly going up. An increase of 35 per cent in the agricultural workers as against an increase of only 10 per cent in the cropped area during 1951-61 resulted in the worker/cropped area ratio to increase from .57 to .69. A similar trend continues throughout the projected period. From the base year of 1968-69 to 1983-84, the number of workers on farms will increase by 37 per cent and the cropped area by only 7 per cent. This will result in the increase of agricultural workers per hectare from .76 to .97, or by 28 per cent.

TABLE 3

AGRICULTURAL WORKERS PER CROPPED HECTARE

Year	Punjab			Maharashtra		
	Cropped area (mil.hec.)	Agri. workers (mil.)	Worker per hec.	Cropped area (mil.hec.)	Agri. workers (mil.)	Worker per hec.
Historical:						
1951	8.06	4.08	.51	17.31	9.80	.57
1961	9.73	4.54	.47	19.09	13.25	.69
Projected:						
1968-69	10.46	4.79	.46	19.68	14.92	.76
1973-74	10.94	5.23	.48	20.13	16.37	.81
1978-79	11.52	5.53	.48	20.59	18.33	.89
1983-84	11.93	5.34	.45	21.05	20.47	.97

TABLE 4

INPUT PER WORKER IN DAYS PER YEAR FOR CROP PRODUCTION

Year	Punjab			Maharashtra		
	Total days (mil.)	Agri. workers (mil.)	Days per worker	Total days (mil.)	Agri. workers (mil.)	Days per worker
1968-69	574.9	4.79	120	1563.1	14.92	105
1983-84	694.4	5.34	130	1767.2	20.47	86

As change occur in the average number of workers per hectare of land, the input per worker in terms of working days in a year also changes unless traditional technology undergoes a transformation.

The average days worked per worker as compared to the corresponding values of agricultural labour per hectare in the two States (Table 4) shows interesting results. While in the Punjab working days per worker are rising inspite of mechanization of certain operations, they are sharply declining in Maharashtra. In 1968-69, a worker in Punjab, on an average, worked in crop production for 120 days, and in Maharashtra for 105 days.4/ The corresponding figures for 1983-84 are 130 days and 86 days, respectively, showing thereby an increase of 8 percent in the working time of the former and a decrease of 18 per cent in the latter.

The nature of the shift in Maharashtra is consistent with what one might expect in small-scale, family-centered farming, subject to rapid population growth. Let us assume (though it is questionable) that farmers in this State are, at present, putting in the right amount of labour (or normal work), measured in human labour days per hectare with a given technology of production. Assume also that additional workers claim at least a subsistence share of the total output because of family ties, and leisure has a positive value farmers. Any increase in the number of workers, and thereby decrease in days worked per worker, will increase disguised unemployment.5/ During the 15-year period ending

4/ In addition to time spent on crop production, a farm worker devotes considerable time (as much as 45 per cent of total working days) on farm work other than crop production such as tending of cattle, marketing of produce, purchase of inputs, etc.

5/ The existence of disguised unemployment is largely a matter of definition and assumptions about institutional forces involved. Disguised unemployment in underdeveloped countries is defined by a zero marginal product of labour and the conditions of ceteris paribus This is considered as the labour which could be removed without effecting output.

1983-84, labour is expected to increase by 5.55 million and cropped acreage by only 1.37 million hectares, which, given the 1968-69 ratio of .76, will require only 1.04 million new workers. The additional, 4.51 million workers actually engaged in agriculture increase the workers per hectare ratio to .97 and decrease the working days to 86 in a year. Had the input of labour per hectare remained the same in 1983-84 as in 1968-69, the total working days would have been 2145.25 million as against 1703.3 million.

The additional 4.51 million fresh workers in agriculture in Maharashtra, amounting to 22 per cent of the total labour force in 1983-84, represent an incremental measure of surplus over and above whatever surplus existed in 1968-69. Nearly two-thirds of the total additional surplus labour force are estimated to be in the category of cultivators and the remaining one-third are agricultural labourers. In the case of cultivators, who are self-employed, disguised unemployment will grow markedly during the projected period. Most of the 3.08 million cultivators, (1.66 million males and 1.42 million females), who enter the work force in this period will be absorbed in agriculture by work-sharing, presumably taking the form of less than the full employment average. A number of small farmers who lag behind in adopting new technology are likely to join the hired labour force. These and the additional surplus of 1.43 million agricultural labourers, composed of .54 million males and .79 million females, will substantially add to the number of workers in this class and thereby aggravate the already serious problem of under-employment and unemployment.

VI. SUMMARY AND IMPLICATIONS

Our analysis indicates that new technology has begun to produce a profound change in the agricultural economy of Punjab. By 1983-84, it is estimated that all the wheat crop in the State will be mechanically threshed, one-half of it will be harvested by reapers, all of the corn will be shelled by corn shellers, 3/5th of the irrigated area will be served by diesel and electric pump-sets and tubewells, and 1/5th of the total area will be cultivated by tractors. With all these changes in the methods of production, total human energy demand will be reduced from the estimated conventional level by 17.4

per cent. Over the projected period, the cropped area will expand by 14 per cent and the farm labour force increase by 10 per cent, reflecting a slight decrease in the workers/ hectare ratio and an increase in the work duration of a farm labourer from 120 days to 130 days per year.

In Punjab, the introduction of labour intensive HYV, coupled with a shrinkage in the hired labour force and rising wages, has led to a progressive mechanization of agriculture. Whilst some forms of mechanization, such as wheat thresher and reapers, ease the problems of growing labour shortages during havesting time, the pump-sets and tractors displace labour, though at the same time they afford opportunities for multiple cropping and thereby increased employment. With intensive irrigation activities and cropping, the time factor becomes increasingly important. Labour is required at all farms at the same time. Delay can entail significant losses in ouput and bullock power is not sufficiently efficient to cope with the high pressure of time-bound operations. This accounts for the thirst for mechanization in Punjab, which is reflected in the high premium farmers are prepared to pay for tractors and other equipment.

Mechanization is having its first effect on the extra peak needs of labour which occur twice yearly, once at the planting time and then at the harvesting-threshing time for wheat. Seed-bed preparation and sowing are very vital tasks in crop production. Regardless of the scale of operation, farmers pay personal attention to these operations; the tractor-owners either drive the machine themselves or closely supervise the hired men. Mechanization of this activity has little effect on regular hired men or casual workers. Harvesting and threshing is another matter; even the smallest farm may rely on some off-farm assistance in cutting the crop; larger farms require a very extensive work force for this operation. The broad need for extra hands over all scales of operation make this activity the one most sensitive to changes in technology. Mechanization of threshing usually involves family and hired workers; it is done under less pressure than cutting. Farmers, therefore, cut casual labour costs and internalize these outlays to

their normal work force. It is at the harvesting time that mechanization will hit casual labour most and will tend to reduce the gap between the wages paid at this time and in other seasons of year. Well-irrigation in Punjab is usually a family operation. Mechanization of pumping, besides allowing women and children to remain at home, affords male workers some relief in their labour input.

Our study in Maharashtra shows that the natural growth of the labour force in the State will provide a surplus of 4.5 million workers by 1983-84. Our data indicate that, by the end of the study period, 30 per cent and 60 per cent, respectively, of the total area under jowar and bajra - the two principal cereal crops of the State - will come under HYV, 1/3rd of the area irrigated will be supplied with water by pump-sets, 1/5th of wheat, paddy, jowar and bajra will be mechanically threshed and tractors will be used on only about 5 per cent of the total area. The labour-displacing impact of pump-sets, threshers and tractors in this State will not be sufficient magnitude to counter-balance the additional demand of human labour resulting from increase in the area under HYV. Rather, there will be an over-all increase of 3.8 per cent. But this increase in demand is too small to have any marked effect on the employment of the rapidly growing labour force, the conversion of disguised into open unemployment amongst farmers, and under-employment and unemployment of agricultural labourers. With limited scope for irrigation and multiple cropping on the one hand, and rapid growth of population on the other, the man-land ratio is fast increasing and the annual average working time of a farm worker is declining.

To sum up, the impact of the agricultural revolution in the two states studied is widely uneven and different. In the predominantly irrigated wheat areas of Punjab, HYV with associated inputs are rapidly gaining ground, hired labour is on the decline and the trend is towards labour-saving, capital-intensive agriculture. In the low rainfall, unirrigated millet regions of Maharashtra low productivity traditional agriculture continues to exist and the absorption of a rapidly growing labour force into productive employment is presenting a serious problem.

A labour-intensive, low-cost technique commends itself to meet such a situation, and Maharashtra can, and probably will, move in the direction of labour-intensity for some time to come.

The impact of the Green Revolution is being largely felt in the irrigated areas which form about 1/5th of the cultivated land in India, and primarily on wheat and rice grown in the winter season. These are the areas where a labour shortage is felt in performing key operations, and the production breakthrough resulting in farm income improvement has led to a demand for mechanization. To encourage selective mechanization for maintaining yield and production increases is a step in the right direction, as with proper handling of mechanization and change in cropping intensity there is a considerable scope, in the irrigated areas, for creating demand for more man-days of labour. Japan uses 3.5 tractor H.P. per hectare of crop land or about double the U.S. figure, yet at the same time it uses 2.04 workers per hectare of land, more than twice that of India. Europe and Japan offer evidence that intensive mechanization and intensive use of farm labour can be profitable inputs on small farms with high yields. In rice growing areas with small fragmented land holdings great opportunities exist for a more intensive use of labour and selective mechanization.

In nearly 4/5th of the cultivated area dependent on rainfall, farmers are often unwilling to make any change in the traditional technology because of high risk. The spread of HYV and overall increase in production has been rather modest. But the exploding farm labour force, and the urgency of increasing the productivity of land and the incomes of both farmers and landless labourers, require the application of new technology and appropriate mechanization. Land preparation and planting of crops to utilize monsoon rains are frequently delayed by the lack of power, and low yielding crops are often grown on residual moisture. In such areas, more power, particularly tractor power, should be a great help in soil conservation, land shaping, timely planting and other operations. In low rainfall areas, such as those found in Maharashtra, dry-farming techniques in agriculture coupled with a dual pattern of industrial development (modern capital-intensive industries and semi-modern small-scale labour-

intensive industries) will greatly help in increasing production and at the same time in solving the serious problem of growing unemployment and underemployment.

In this analysis only the technical changes in agriculture of the two states have been examined in a purely physical sense as labour-using or output-increasing or labour-saving, and no attempt has been made to go into the impact which agricultural development will have on employment in the non-farm sectors. Sustained expansion in farm production largely depends upon the availability of necessary inputs and an adequate infrastructure. An increase in farm incomes results in the increased use of consumer goods in rural areas. The degree to which the agricultural sector is stimulating the growth of manufacturing units for inputs and consumption goods, rural and urban workshops, marketing, transportation, storage and distribution of additional agricultural produce by railroad and highways, sale of production requisities and consumer goods, food processing, etc. and thereby increasing employment opportunities for absorption of surplus farm labour, is a subject which needs a separate detailed study.

APPENDIX

METHODOLOGY

The method employed in this study for the measurement of the potential impact of HYV and other important technological changes is given below:

(a) Supply of Human Energy

The main sources of conventional energy available to farmers in India for crop production are human beings and animals. In this paper we will deal only with human energy. In a predominantly agricultural country, farm labour supply grows over time as the population multiplies.

The projections for total human population are based upon the parameters estimated by the Expert Committee on Population set up by the Planning Commission. Of the three sets of projections based on three alternative assumptions on future trends in fertility (high, medium and low), we have selected the medium set for our study (6).

From the total population the number of workers in Punjab has been determined on the basis of the proportion of workers to total population as observed in various Censuses since 1921, and in Maharashtra by assuming rates of increase or decrease in the 1961 participation rates by sex and broad age-groups separately for rural and urban population. The methodology followed is similar to the one adopted by the Expert Committee in estimating the all-India labour force in future years. In view of progressive industrialization and urbanization and expansion of educational facilities in the country it is assumed that labour force participation rates will show a decreasing trend over the future years in the case of both males and females in the rural areas. In the urban areas the participation rates for males in the age-group of 15-35 years are likely to fall because of the possibility of their availing expanded educational facilities. The rate of

female participation in urban areas is likely to rise because of economic factors and an upward trend in the age at marriage The Expert Committee, by a process of trial and error, has suggested some assumptions which, with some modifications, have been adopted in determining the labour force participatio rates.

The farm labour force has been determined as a residual from the total work force after estimating the rate of growth of non-farm employment, taking into account past trends and future programs of non-farm development. The farm workers are composed of two groups: the cultivators and the agricultural labourers.6/

The distribution between the two categories of farm workers has been made on the basis of observed changes in the participation rates between 1951-61 in Punjab, and only on participation rates in 1961 in Maharashtra, as a satisfactory trend in participation rates in this State could not be set up.

The farm labour force thus calculated is composed of workers of both sexes and all age-groups. By taking the working capacity of minors (0-14 years) and aged persons (60 years and above) equivalent to one half of the workers in the age-group of 15-59 and of the female workers as 3/4th of the male workers, the effective working force in terms of adult male units was worked out for Punjab. But in Maharashtra male and female workers have been treated separately as the latter constitutes an important ingredient of the farm labour force.

Given the total strength of the agricultural workers, the share of the energy supply used for crop production has been calculated after making an allowance for (a) time devoted by farm workers to other works, such as attending to animal husbandry, private and social activities, and (b) time lost due to bad weather and sickness (9,10,11).

6/ Cultivators include all persons who own or hold land and work on it, that is full-time owner-operators, tenants, owner-cum-tenants and operators who earn a part of their income off-farm. Agricultural labourers are those, who sell labour to farm operators for wages in cash, kind or share of the produce.

(b) Demand for Human Energy

The requirement of human energy for crop production has been determined on the basis of

i) expected cropping pattern over the projected year; and
ii) physical inputs of labour.

The projection of the cropping pattern involved the estimation of the land-use pattern by extrapolating the trends observed in the past in total arable land and uncultivated areas and taking the net sown area as a residual. The net sown area was then broken up into two classes, irrigated and unirrigated, the former having been worked out by taking into consideration the projections made by the Planning Commission and State Plans for different types of irrigation works, and the latter by subtracting the irrigated area from the total area. The gross cropped area was then determined by estimating the crop intensities for the two parts, based on trends in crop intensities observed for irrigated and unirrigated areas since 1950-51. The projected gross cropped area for future years was allocated to different crops on the basis of the percentage of the total area under each crop as estimated by fitting a straight line trend to the data for the period 1950-51 to 1967-68 and determining the limits of variation and optimal cropping pattern by using a modified linear programming approach (4,15).

The farm management and cost of production studies in the two states were utilized to estimate the per-acre labour requirements for various agricultural operations on various crops. These figures were split up among the months according to the timing for performing various crop operations. The energy requirements of different crops and the total monthly requirements for the state were then worked out by a simple mathematical process of multiplying the man days per acre by the numbers of acres under various crops and then adding up the results.

(c) Rate of Adoption of Technological Changes

In working out the proportion of area under HYV and area irrigated by different methods (pump-sets, canals etc.), we made use of the projections of the Planning Commission and our own estimates of the area under different crops. For tractors, their number and the area likely to be covered by the end of study period have been determined, taking into account the likely supply and demand position in future, as estimated by various governmental and other agencies, horse-power of the tractor units, present trend in their use, and the pattern of farm operational holdings in the two states. More or less, a similar procedure has been followed for the other mechanical devices, but in these cases we have largely depended upon the estimates of experts close to the subject and our own observations of the situation in the two areas, especially for such items as reapers, which have just appeared on the scene but have yet to gain a firm ground.

(d) Labour-machine Displacement Rates

Finally the labour-machine displacement was estimated and its impact on human labour demand was calculated. The rates adopted have been given as footnotes of Table 2a and 2b. These are mainly based on the results of the studies carried out by Kahlon and Gill (14) in Punjab and Acharya in Maharashtra.

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THE GREEN REVOLUTION, AND AGRICULTURAL EMPLOYMENT UNDER CONDITIONS OF RAPID POPULATION GROWTH: THE PAKISTAN PROBLEM

Dr. S.R. Bose

I. Introduction
II. Population and Labour Force: Past Trends and Future Prospects
III. Labour Absorption in the Non-Agricultural Sector
IV. Green Revolution, Labour Absorption Possibilities and Implications for Agricultural Development Policy
V. Conclusion.

I. INTRODUCTION

In under-developed countries, a large majority of the population and the labour force live on the low productivity traditional sector - mainly agriculture - while a small proportion is engaged in the relatively higher productivity modern, non-agriculture sector. Agriculture is burdened with surplus labour in most of these countries, such as Pakistan. Also the population is growing at a high rate. It is generally recognized that economic development in such countries will require a massive shift of the labour force from the agricultural to the non-agricultural sector. Since a smaller proportion of the labour force would then have to support a larger proportion of the population in the non-agricultural sector, it follows that agricultural productivity per farm worker has to be increased (unless large food imports are to be relied upon). As a matter of fact, developing countries, as and when they succeed in significantly raising their GNP per capita , also modify the structure of the economy in this direction. The fact

that around 7 per cent of the households in such countries are engaged in agricultural production to feed their own family members and a relatively small percentage of the population living in urban areas, is clearly indicative of the low level of agricultural productivity.

The necessity of rapid industrialization and the inevitability of a shift of the labour force towards industry cannot be questioned. However, the process of structural transformation must necessarily be slow in countries where the bulk of the labour force is in agriculture and population growth is rapid. Countries such as Pakistan cannot expect to achieve such a transformation of the economy in the next two decades, even if the overall growth of GNP is quite rapid. It will take a longer time. Meanwhile, inspite of a rise in the proportion of the labour force engaged in the non-agricultural sector, the size of the residual labour force must grow in absolute terms. This indicates the magnitude of the employment problems that such a country has to face. An awareness of this perspective is very important for designing policies in the transitional period. It has certain important implications for land reforms and the choice and phasing of technical innovations in agriculture. In this paper I shall primarily focus on the employment problem in Pakistan and consider some of the implications for agricultural development policies.

Because of a high rate of population growth, even a small rise in per capita income increases demand for food substantially. Agricultural development policy, therefore, naturally emphasizes the need for the attainment of self-sufficiency in food grain production. I shall contend, however, that the employment problem has also to be effectively tackled in order to avoid or at least mitigate the likely social unrest resulting from massive unemployment. It will be argued that in countries such as Pakistan (particularly its east Wing) some stop-gap policies should be adopted for absorbing an increased number in agriculture, while facilitating the fastest possible growth of the non-agricultural sector which will eventually absorb a much larger labour force and permit a reduction in the size of the farm labour force.

The fact that even a very highly optimistic rate of growth of the non-agricultural sector in Pakistan in the next 15 or 20 years would not absorb the additions to the total labour force is usually conceded by many, but the relevant policy implications are often missed. Utilization of the surplus labour on construction projects or other activities to build capital is by now a well-known idea. It has, however, been found difficult to implement it in practice in most countries if labourers have to be hired at the ruling wage rate. In Pakistan's experience, such employment through the Works Programme could be provided to considerable numbers only when large supplies of PL 480 food grains were available in a situation of domestic food shortage. The alternative of employing surplus labour in cottage crafts faces the problems of capital requirement and food supplies for these people and an adequate market for their products. As the situation stands now, it seems highly unlikely that such large numbers as are involved in our situation can be absorbed in an expanded cottage industry programme. Therefore, it is argued in this paper, in order to cope with the magnitude of the problem, agricultural development policy in Pakistan (especially in East Pakistan) while designed for raising output should be employment oriented. Because of the opportunities offered by the so-called green revolution in agriculture, employment and output objectives are not seriously conflicting.

II. POPULATION AND LABOUR FORCE - PAST TRENDS AND FUTURE PROSPECTS

In the last two decades population grew at a high rate in both East and West Pakistan. Census data available for 1951 and 1961 indicate a growth of population of nearly 2.5 per cent per year during the period. Sample estimates of population made in recent years indicate an even faster rate of population growth in the 1960's. Official estimates of the 1970 population are about 72 million in East and 60 million in West Pakistan. The projections of population based on various moderate assumptions regarding fertility and mortality indicate that by 1985 East Pakistan's population will be around 108 million and West Pakistan's

population will be around 85 million (indicating a growth rate of approximately 2.6 per cent annually).

The rapid growth of population is bringing in its trail a rapid growth of the labour force, with a lag of 10 to 12 years because a surviving child born in a particular year joins the labour force 10 to 12 years later. Already the rapid growth of population experienced since the mid 1950's has substantially augmented the labour force by the mid 1960's. In the coming years also the labour-force will be growing fast. Projections of the labour force based on the participation rates obtaining in 1961 indicate that in 1970 the labour force in East Pakistan (age 10 years and above) is around 24 million and in West Pakistan around 18 million, and by 1985 this figure will be about 40 million and 30 million respectively (Table 1).

TABLE 1

PROJECTION OF LABOUR FORCE IN PAKISTAN (1965-85) AGE 10 AND ABOVE;

(in millions)

	(mid-year)					Annual compound rate of growth
	1965	1970	1975	1980	1985	1970-85
East Pakistan	20.5	24.6	29.3	34.6	40.7	3.4%
West Pakistan	15.9	18.5	21.7	25.3	29.2	3.1%

Source & Notes: Obtained by using the lowest of the population projections for Pakistan made by Lee Bean and others in "Population Projections for Pakistan 1960-2000", PIDE Monograph, Karachi 1968, and applying the labour force participation rates as obtained in 1961 used by S.R. Bose in "Labour force and Employment in Pakistan 1961-86: A preliminary Analysis", P.D.R., Autumn 1963.

III. LABOUR ABSORPTION IN THE NON-AGRICULTURAL SECTOR

In the last two decades only a fraction of the addition to the labour force was absorbed in the growing non-agricultural sector with the result that the residual increased the size of the agricultural labour force, particularly in East Pakistan. At this stage of economic development it is quite legitimate to assume that even in the relevant future the change in the size of the agricultural labour force will be residually determined by the extent of labour absorption in the non-agricultural sector.

In the intercensal period 1951 to 1961 there was a phenomenal growth of non-agricultural investment and output in West Pakistan, and the associated rapid increase in non-agricultural employment raised its share in the total labour force from 35 per cent to 41 per cent. In this period the non-agricultural labour force grew at a rate of 4.5 per cent per annum compound rate* which has probably been surpassed only by Taiwan in recent years.** Still, the absolute size of the agricultural labour force increased considerably in this period in West Pakistan.

We assume that this 4.5 per cent annual growth rate of labour absorption in the non-agricultural sector in West Pakistan has been maintained till 1965 and that the share of this sector in the total labour force in 1965 stood at 44 per cent. From 1965 to 1970 a 4.2 per cent annual growth rate is assumed in view of the disturbed conditions during part of this period. From 1970 to 1985, three alternative growth rates (3.5 per cent, 4.5 per cent and 5 per cent yearly) are assumed for the projection of the non-agricultural labour force in West Pakistan (Table 2). It should be noted that a 4.5 per cent growth rate is very optimistic because of the prospective shift in inter-wing investment allocation in order to step up the growth rate in East Pakistan. The growth rates of employment projected for East Pakistan in

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* Census of Pakistan 1961 and 1951.

** Bruce F.Johnston, "Agriculture and Economic Development: The Relevance of the Japanese Experience" Food Research Institute Study, 1966.

this paper will be impossible to relize unless a drastic change in investment allocation in its favour is effected in the coming years.

In East Pakistan, contrary to the experience of other developing countries or regions, the share of the non-agricultural sector in the total labour force declined from 17 per cent to 15 per cent between 1951 and 1961.*** In this inter-censal period, the rate of growth of non-agricultural labour force has been only 1.5 per cent per year, while the urban population grew at 4.3 per cent per year. Significant increases in investment suggest that the growth rate of the non-agricultural labour force in the 1960's is likely to have been higher than 1.5 per cent per year, and consequently the proportion of the labour force in the non-agricultural sector has probably gone up by a few percentage points. There has also been an increase in the share of the non-agricultural sector in the total gross provincial product of East Pakistan, from 33 per cent in 1950/51 to 38 per cent in 1960/61 and to 42 per cent in 1963/64 the latest year for which the break-down is easily available. This however, does not necessarily indicate any increase in the share of the non-agricultural sector in the total labour force. But we assume, somewhat arbitrarily, that in East Pakistan the proportion of the labour force in the non-agricultural sector has been 15.5 per cent in mid 1965 and is 16 per cent in mid 1970. For projecting the size of the non-agricultural labour force in East Pakistan from 1970 onwards, we assume growth rates of non-agricultural employment which are very optimistic: 3.5 per cent, 4.5 per cent, and 5 per cent per year (Table 2).

These projections indicate that even with optimistic assumptions of 3.5 and 4.5 per cent annual growth of employment in the non-agricultural sector, the size of the residual labour force which will presumably remain in agriculture will increase by about 3 to 4 million in West Pakistan and 12 to 13 million in East Pakistan between 1970 and 1985.

*** Census op.cit.

Even a 5 per cent annual growth rate of non-agricultural employment would not appreciably change the position in East Pakistan, while in the West it would stabilize the size of the farm labour force by 1980-85, after raising it by about 1.5 million.

TABLE 2

PROJECTION OF LABOUR FORCE ABSORPTION IN NON-AGRICULTURE SECTOR 1965 - 1985

	(mid-year)					(in millions)
	1965	1970	1975	1980	1985	1970-85 Annual Compound rate of growth
			A. West Pakistan			
Projection I	7.0	8.6	10.2	12.1	14.4	3.5%
Projection II	7.0	8.6	10.8	13.3	16.6	4.5%
Projection III	7.0	8.6	11.0	14.0	17.9	5.0%
			B. East Pakistan			
Projection I	3.2	4.2	4.8	5.6	6.7	3.5%
Projection II	3.2	4.0	5.0	6.2	7.7	4.5%
Projection III	3.2	4.0	5.1	6.5	8.3	5.0%

Sources & Notes: Total labour force as shown in Table 1. Assumptions about growth rate of non-agricultural employment.
1965-70: E.P. 4.5% yearly; W.P. 4.2% yearly;
1970-85: as noted in the last column.
Figures refer to mid-year in each case.

TABLE 3

PROJECTION OF LABOUR FORCE IN AGRICULTURE AS RESIDUAL, 1965 - 1985

	(mid-year)				(in million)
	1965	1970	1975	1980	1985
	A. West Pakistan				
Projection I	8.9	9.9	11.5	13.2	14.8
Projection II	8.9	9.9	10.9	12.0	12.6
Projection III	8.9	9.9	10.7	11.3	11.3

Continued

	(mid-year)				(in million)
	1965	1970	1975	1980	1985
B. East Pakistan					
Projection I	17.3	20.6	24.5	29.0	34.0
Projection II	17.3	20.6	24.3	28.4	33.0
Projection III	17.3	20.6	24.2	28.1	32.4

Sources: Table 1 and Table 2, obtained as residual.

Even if one contends (although with no good reason) that the total labour force projections are somewhat biased on the high side, the employment problem is not significantly altered. Firstly the share of the non-agricultural sector in the total labour force assumed for 1965 or 1970 may be higher than the actual. Moreover, a projection of 4.5 or 5 per cent growth of non-agricultural employment in both East and West simultaneously is very high and optimistic. Their combined effect is to understate the size of the residual labour force.

In the past output grew faster than employment in the non-agricultural sector. Since some increase in labour productivity in this sector must be expected in the future as well, the rate of employment expansion will be slower than output expansion. This tendency will be reinforced to the extent capital intensity is increased. The increased emphasis on intermediate and heavy capital goods, particularly in West Pakistan, is likely to raise the capital intensity of the manufacturing sub-sector.

The capital-labour ratio, i.e., the value of fixed capital per man-year of employment, is quite high in Pakistan's large-scale manufacturing industries. It is higher than the country's factor endowments seem to indicate as socially desirable. In quite a few cases it has been found to be higher than in Japan. For 1965/66 a set of capital-labour ratios computed for 20 large and medium scale industries (combined) indicate a range from Rs 5,000 to

Rs.146,000 in East Pakistan and Rs.4,000 to Rs 217,000 in West Pakistan*. The simple average is Rs 22,000 in East and Rs 29,000 in West Pakistan. A weighted average taking into account the volume of employment in these industries could not be obtained. For 1962/63 such a weighted average for 18 industries was found to be over Rs 16,000 in West Pakistan. This figure may be considered to be a reasonable approximation for 1965/66 in both East and West Pakistan. Capital-labour ratios in 13 small scale industries have been estimated to be between Rs 385 and Rs 5,000 in East Pakistan, and between Rs 622 and Rs 4,000 in West Pakistan, the averages being Rs 1,500 in East and Rs 2,225 in West Pakistan. In services and power generation (construction, transport, trade, miscellaneous services, and electricity_. The estimated capital-labour ratios range from Rs 1,000 to Rs 164,000 in East and Rs 810 to Rs 67,000 in West Pakistan** Excluding electricity which has a very high capital requirement per worker, the average comes to over Rs 6,000 in both East and West Pakistan, which is low because a lot of under-employment and disguised unemployment exist in trade and miscellaneous services.

Assuming 15 per cent of the non-agricultural labour force to be in large and medium industries, 15 per cent in small industries and the remaining 70 per cent in transport and services in both East and West Pakistan, the average capital labour ratio comes to about Rs 7,300 in East and Rs 7,400 in West Pakistan. Adding the capital requirement for providing some minimal urban housing and related facilities to a worker's family the total capital requirement per worker in the non-agricultural sector may be around Rs 12,000 in both wings.

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* A.R. Khan, "Capital-Labour Ratios and Labour Requirements in the Pakistan Economy" (mimeographed) PIDE, April, 1970 The estimates are based on replacement values which are obtained from book values by making adjustment for two factors: (a) the discrepancy between actual physical deterioration in Production capacity and depreciation practices and (b) the rising price of capital goods.

**A.R. Khan, ibid.

These estimates are average ratios derived from ex-post magnitudes. If, however, they roughly indicate the incremental capital-labour ratios in the non-agricultural sector, the capital requirement for the projected growth of employment in this sector would be quite large, if not staggering. In the past the manufacturing sub-sector of the non-agricultural sector provided employment to a small fraction of the labour force in this sector. Many workers who drifted to the urban areas became absorbed in trade and miscellaneous services which have considerable under-employment. In future more meaningful employment expansion in manufacturing and services is likely to raise the capital requirement per worker employed in the non-agricultural sector.

The maximum feasible rate of non-agricultural employment (or output) growth will be determined mainly by the amount of capital resources that can be mobilized and by the demand for output at home and abroad. Even leaving aside the question of industrial skills, the capital resource limitations would hardly permit a higher growth rate of non-agricultural employment than those projected above.

The possibilities of introducing more labour intensive techniques in the non-agricultural sector should be explored and, wherever feasible, implemented. However, the technological choice in some cases may not be very wide because the equipment is in most cases produced in capital-rich countries to suit their conditions. An appropriate pricing policy with regard to foreign exchange and capital limitations would, to some extent, influence the decisions of investors towards choosing a less capital intensive technology. However, a programme of wage subsidy to encourage employment is beset by very serious administrative problems and, therefore, may not be a practical proposition. In any case it seems clear that much more employment would be needed than the non-agricultural sector can provide in the next 10 or 15 years.

To sum up, while the rate of industrialization, especially in East Pakistan, should be accelerated to the extent permitted by the scarce resources the employment implications of alternative development strategies in agriculture should be seriously considered. Agriculture will have to absorb the residual labour force for quite a long period, particularly in East Pakistan, if open unemployment and excessive influx into the urban areas is to be avoided.

IV GREEN REVOLUTION, LABOUR ABSORPTION POSSIBILITIES AND IMPLICATIONS FOR AGRICULTURAL DEVELOPMENT POLICY

Since the mid 1950's in the face of continuing food shortage, agricultural development policy laid emphasis on raising agricultural output as much as and as quickly as possible. Where ever any likely conflict between the objec ives of raising output and increasing employment in the agricultural sector was visualized, the output objective was given a clear preference. For example, the Food and Agriculture Commission in 1960, while recognizing the "fear of wide-spread unemployment as a valid one", favoured agricultural mechanization because "to ignore it may be to forfeit a valuable ally in the production war"*.

Until recently the possibility of adopting labour intensive strategies for agricultural development did not appear to be a realistic and encouraging proposition. The highly labour intensive approach to agricultural development adopted in Japan and Taiwan was cited as a worthwhile example to follow; but this did not inspire by confidence in their potentialities in other developing countries. However, the recent development of new dwarf varieties of rice and wheat, which are highly responsive to fertilizer use and are suitable for cultivation in tropical regions, has radically changed the situation. This seed fertilizer package is transforming production possibilities in a number of developing countries such as Pakistan. Widespread adoption and use of these seed varieties, together with

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* Report of Pakistan Food and Agriculture Commission 1960; p. 110.

large increases in fertilizer use, offer prospects of rapid increases in production at a relatively low cost. Also, this output exapnsion can go along with a considerable increase in productive employment in agriculture. There does not seem to be any serious conflict between the objectives of employment expansion and of output growth. A broad development approach to raising the output of the large majority of cultivators by labour intensive techniques, can raise production and employment in agriculture to a considerable extent even where the underlying man-land ratio is highly unfavourable, as is the case in East Pakistan.

The prospect of realizing these possibilities depends on an appropriate choice of agricultural techniques and the timing and phasing of their adoption, and also on the necessary institutional reforms, specially in regard to land relations.

It has been found in a number of countries that production per acre is inversely related to farm size. A reasonable explanation of this is not hard to obtain. It has been suggested that since alternative employment opportunities are few, the small farmer would tend to use his own and the family labour up to a point where additions to output resulting from labour-use are positive. On the other hand, large farmers would hire additional workers only up to the point where the additional cost (wages) is matched by the additional return.

These high-yielding seed varieties require more intensive operations at all stages of cultivation for satisfactory results -higher doses of fertilization, weeding, transplanting, and application of pesticides. Also a heavier crop involves more work in harvesting and threshing. Quantitative estimates of the additional work involved in properly growing the new varieties of crops in place of the traditional ones have not been made in Pakistan. But it is certainly significant for the Mexican wheat varieties, and even more so for the IRRI rice varieties. However, the extent to which the increase in farming production resulting from a spread of the seed-fertilizer revolution, is associated with the actual increase in productive employment in agriculture will be determined by the technical means and the institutional arrangements adopted to realize the potential of the new crops.

The seed-fertilizer revolution or the green revolution has been spreading rapidly in West Pakistan. The area planted with the dwarf wheat varieties increased from 12,000 acres in 1965/66 to over 4 million acres in 1969/70. Even more rapid has been the rate of adoption of IR-8 rice variety which in a period of 3 years has covered over 1 million acres or one-third of the total rice acreage in West Pakistan. This development has brought West Pakistan to the threshold of self-sufficiency in food grains. If adequate markets existed it would be able to market a surplus.

So far this development has been confined to medium and large farms. But as the success story spreads and the new farming practices become widely known, and if credit and inputs can be made easily available, smaller farms are also expected to adopt these innovations which are neutral with regard to scale, i.e., farm size. The new seed-fertilizer combination offers opportunities for effectively pursuing a labour-intensive type of approach to agricultural development like that of Japan or Taiwan. A system dominated by small farms is, therefore, well suited to the adoption of new innovations with the additional advantage of a much larger labour absorption in agriculture than would be possible in large farms using hired labour. Adequate efforts to spread the seed-fertilizer revolution to the smaller farmers, and institutional reforms to reduce the great inequality in farm size distribution (also land ownership) to create a system to family farms, would increase the opportunities of productive employment in agriculture.

There is, however, a contrary opinion which holds that the realization of the full potential of the new seed varieties requires the introduction of agricultural mechanization and the replacement of animal draft power by tractors and tractor-drawn implements. The introduction of tractor mechanization would, however, substantially reduce the potential employment opportunities in agriculture offered by the seed-fertilizer revolution. It would even displace many farm labourers from their erstwhile occupation and reduce the existing level of productive employment in agriculture. But the tendency to mechanize farms is very powerful in West Pakistan partly because those who machinze (mostly large landowners or farmers) are able to obtain

machinery at a relatively low cost at the official rate of exchange plus only 25 per cent added by way of taxes, and with cheap credit (7 per cent interest) payable over a long period. Such mechanization benefits the large farmer because it reduces his labour requirements substantially and also allows him to get rid of his tenants from the land and to keep their share - either one-half or one-third - of the produce to himself.

Such mechanization primarily reduces labour requirements at all stages of cultivation, and does not raise yield appreciably. It certainly solves the problem of labour shortage at the peak season of wheat harvesting, threshing and land preparation for the next crop. But this peak problem can be resolved by introducing suitable threshers and releasing the bullocks for land preparation. Also relatively higher wages would attract enough people from the urban as well as the rural areas, including many secondary school students and even womenfolk, for seasonal work at harvest time.

There are already over 17,000 wheel type tractors in West Pakistan and the number is increasing by over 10 per cent annually. About 15,000 of them are privately owned, of which over 90 per cent are owned and operated by large farmers with over 25 acres. The average size of the holdings of tractor-using farmers is 267 acres, of which 228 acres are cultivated.*

The size distribution of farms and the distribution of land ownership are already very unequal in West Pakistan. About 8 per cent of the farms of 25 acres and above have 42 per cent of the farm area. The ownership pattern is even more unequal - 7 per cent of the owners own 53 per cent of land (Table 4). The difference between the two is largely explained by the existence of as many tenant farms as owner farms (2 millions each) and about 1 million owner-cum-tenant farms.

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* Source: Agricultural Census Organization, Data for 1969.

TABLE 4

FARM SIZE DISTRIBUTION AND LAND OWNERSHIP PATTERN IN WEST PAKISTAN (SUMMARY STATEMENT)

A. Farm Size

Size	Percent of Farms	Percent of Farm Area	Total Farms (Million)	Total farm area (Million acres)
0-25 acres	92	58	4.5	28
25 acres and above	8	42	0.4	21

B. Land Ownership

Size	Percent of owners	Percent of Land owned	Total owners (million)	Total Land (Million Acres)
0-25 acres	93	47	4.7	23
25 acres and above	7	53	0.3	26

Sources : Farm Size - Agriculture Census 1960.
Land ownership-'Land Reforms Commission 1959', West Pakistan Report.

The spread of tractor mechanization will create a 'dualism' within the agricultural sector and make the farm size distribution even more skewed. Large farms will increase in size as mechanization progresses, and the increases in output and generation of marketed surplus for urban requirement and exports will be concentrated in such farms, while employment will be reduced. The farm area in the small family farms will be considerably reduced as a result of this development. And this reduced area would be required to absorb a much larger agricultural labour force than before. It is likely that a portion of this labour force would drift to urban areas and to be 'absorbed' in the miscellaneous 'service' sector.

Introduction of land reforms to create a system almost entirely consisting of family farms will help considerably in the context of the seed-fertilizer revolution to absorb increases in the labour force and population till such time as the non-agricultural employment catches up with population growth. Improved practices associated with the seed-fertilizer package can be adopted within a structure of small family farms if knowledge, credit facilities and markets are made available to them. Also these farms may employ many more people and also create an adequate marketed surplus at a relatively low cost compared with that required for the mechanization of large farms.

In East Pakistan the cultivation of the new high yielding rice varieties has not yet become wide-spread. They are planted in about 1 million acres out of the 23 million acres of cultivated areas. The technological problems in the adoption of the new seed-fertilizer package in East Pakistan have not yet been fully resolved. These varieties are not suited to the monsoon flooding conditions, and their adoption has been limited to the extent of the development of irrigation facilities in the dry season through low-lift pumps using surface water, tubewells, and gravity flows via canals. Unlike West Pakistan, the initial results are not very successful. But as the technological problems are resolved and the irrigation facilities expand, the adoption of the new seeds may be expected to accelerate provided there is the support of proper extension work, input supplies and price policies.

However, the possibility of the extension of dry season irrigation through low-lift pumps is limited by the availability of surface water. Out of about 4.5 million acres which can potentially be irrigated in this way, 2 million acres are already getting water through seepage or otherwise. All of the remaining 2.5 million acres cannot be irrigated because pumping out large quantities of water from rivers increases the danger of saline incursion from the sea. Experts have estimated that within the safety limit only about 1.3 million acres can be irrigated by pumps*.

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* Professor Thijsse, "Preliminary Comments on Hydrology of East Pakistan" Quoted in J.B. Hendry and U Hpu, "East Pakistan Agriculture during the Third Five Year Plan....."Dacca, 1964.

This limit has nearly been reached by 1970. Such irrigation makes possible one IRRI rice crop (or some other winter crop) in places where practically nothing could be growing during winter.

In addition nearly ½ million acres are irrigated by tubewells installed in recent years. Tubewells are suitable for relatively high level land provided the aquifer potential and the extent of recharge is adequate. Since extensive hydrological studies have not been undertaken the potential extent of tubewell irrigation is not yet known for East Pakistan where more than one half of the cultivable land is flooded during the monsoon. This type of irrigation makes water available all the year round and usually results in one extra crop. Irrigation also promotes the introduction of the new high yielding seed varieties and the improved farming practices associated with them. As they spread over larger areas, potential opportunities for productive employment in agriculture will increase to some extent unless, of course, labour-saving innovations such as tractors and tractor-drawn implements are introduced as the green revolution spreads.

Since a larger proportion of land is flooded during the monsoon and is not susceptible to application of the new seed-fertilizer combination, the potential employment creation in East Pakistan's agriculture will be very small relative to the requirement unless a technological breakthrough is made in growing high-yielding, fertilizer-responsive crop varieties under flood conditions, or flood control and irrigation are provided to these areas.

There is not so much of a concentration of land under large farms in East Pakistan. The system is dominated by small owner-operated family farms. Some land is, however, cultivated on a share-cropping basis. The average farm size is about 2.5 acres compared with 10 acres in West Pakistan. But even then there is some room for improving employment opportunities by reducing the land ownership ceiling and the farm size at the top level.

TABLE 5

FARM SIZE DISTRIBUTION IN EAST PAKISTAN

Size	Per cent of farms	Per cent of farm area
0-12.5 acres	96.5	81
12.5 - 25 acres	3	14
25 acres and above	0.5	5

Source : Pakistan Census of Agriculture 1960

It is not, however, suggested that such institutional changes and the spread of the seed-fertilizer revolution along with the extension of irrigation facilities can create enough productive employment for the residual labour force in agriculture. The underlying land-man ratio in East Pakistan's agriculture is already extremely low and would be further reduced in the coming years as population increases.

These rather grim prospects emphasize the need for something to be done to make possible the spread of the green revolution to areas which are now perennially flooded during the monsoon. Furthermore, some rural works programme on an extended scale will have to be pursued in the next decade as well if the magnitude of the employment problem is to be kept within managable limits.

V CONCLUSION

Economic development and modernization, and the structural transformation that goes with it, have been made such more difficult by rapid population growth. An effective population policy apart, utmost efforts should be made to mobilize scarce resources for accelerating the rate of industrialization, particularly in East Pakistan. It should be realized, however, that even with a highly optimistic growth of industry, agriculture would have to absorb a large addition to its labour force in the next

two decades. This problem would be much more serious in East than in West Pakistan. It follows that the rate of industrialization and overall economic growth has to be considerably higher in East Pakistan in order to cope with the prospective employment problem.

The agricultural development policy should be employment - oriented in both wings, particularly in East Pakistan. With the potential opportunities offered by the high-yielding seed varieties, there seems to be no serious conflict between the objectives of increasing agricultural production and employment. What is required is a conscious policy aimed at realizing these opportunities through labour intensive and capital-saving methods, and appropriate reforms in land relations. Although the magnitude of the problem is less staggering in the West it is necessary to adopt such policies there as well, partly to permit a more rapid economic growth in East Pakistan.

In East Pakistan the need for the implementation of such as agricultural development policy cannot be overemphasized. In addition, there should be an Executive Works Programme in East Pakistan as part of the stop-gap policy of increasing labour force absorption outside the non-agricultural sector till such time as the growth of employment in the non-agricultural sector catches up with population growth.

SURPLUS LABOR IN TURKISH AGRICULTURE*
(1962 - 1972)

Yusuf O. Hamurdan

I. Introduction
II. Content of the Existing Estimates of Surplus Labor in Agriculture
III. Data and Methodology
IV. Corrected Global Results
V. Own Estimates of Seasonal Surplus
VI. Conclusion
VII. Appendix
VIII. Footnotes
IX. Selected References

I. INTRODUCTION

In the early 1960's, the issue of surplus agricultural labor started to receive wide attention in Turkey. In fact, Development Plans gave some estimates of surplus labor, and basically adhered to the zero marginal productivity concept together with the ceteris paribus assumption. The First Five Year Plan (1963-67) included an estimate of 8 to 10 per cent surplus labor for the busiest season and 85 per cent for the slack season in 1960-62. The Second Five Year Plan (1968-72) indicated a surplus of 9 per cent and 77 per cent respectively, for the busiest and slack periods in 1967.1/

A re-evaluation of the existing work on this issue is needed as a background for the preparation of the Third Five Year Plan. Furthermore, towards the end of the 1960's, some questions were raised about the validity of the estimates given in the Development Plans.2/ The purpose of this paper is to attempt to shed some more light on the issue of surplus agricultural labor in Turkey.

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1/ See footnotes at end of article.

For those who are interested in the theoretical aspects of the issue we recommend to look elsewhere.3/

The empirical aspect of the surplus labor problem is largely a matter of definition. Accordingly, in this paper we try to examine carefully the existing estimates of surplus labor in agriculture, and present corrected estimates of our own.

II. CONTENT OF THE EXISTING ESTIMATES OF SURPLUS LABOR IN AGRICULTURE

There is no publication explaining the methodology and the results of the estimates contained in the F.F.Y.P. Even the files were not available for re-checking the calculations. Therefore we only reproduce here the result of that work as it appeared in the Plan document. (See Table 1).

TABLE 1

DISTRIBUTION OF SURPLUS OR DISPENSABLE POPULATION IN AGRICULTURE

By months of Peak and Lowest Activity

(in thousands)

Years	July	January
1955	400	7,400
1960	800	8,300

Note: In July 1962 the disguised unemployed were estimated at 1 million.

Source:FFYP, p.400, Table 352.

For the SFYP, an elaborate study covering the 1959-64 period was done in the State Planning Organisation and a publication was produced explaining in a very brief fashion

the methodology followed and the results obtained.4/ Before reviewing its methodology let us present here the results of this study. (See Table 2).

TABLE 2

YEARLY AVERAGE NUMBER OF DAYS EMPLOYED*
IN AGRICULTURE

Years	Crops**	Livestock	Total
1959	95.8	53.4	149.2
1960	99.5	51.2	150.7
1961	90.2	49.2	139.4
1962	93.2	48.3	141.5
1963	101.8	47.6	149.4
1964	93.4	48.0	141.4

*Average workday is assumed to be 8 hours net, i.e., covering the time period spent working in the fields, or transporting the crop to the farm-house.
**Based on unadjusted SIS crop production and area figures.

Source: Ref. No.7, p.13 Table III.

If we arbitrarily assume a 300 day work year in rural areas (but not necessarily in agricultural activities) the surplus or unutilized labor available, which is implicit in this result, would be equal to about half of the labor time available in a year, during the period 1959 to 1964. (See Table 3).

A second study was done in the State Planning Organisation, again by the same group and using much the same methodology, but this time preparing seasonal estimates of agricultural labor requirement. There is no publication explaining this work; however, the files of both the first and the second study are well kept and are available for study. The results of the seasonal labor requirement estimates are published in the SFYP. (See Appendix Table I and II).

The surplus labor for the peak period, estimated by this second study and presented in the SFYP, shows a declining trend during the 1967-72 period. (See Table 4).

TABLE 3

YEARLY AVERAGE NUMBER OF IDLE DAYS IN AGRICULTURE

Years	No. of Idle Days	Idle Days as a % of the days available (i.e., 300)
1959	150.8	50.3
1960	149.3	49.8
1961	160.6	53.5
1962	158.5	52.8
1963	150.6	50.2
1964	158.6	52.9

Source: Table 2 above.

TABLE 4

PEAK PERIOD (JULY-AUGUST) SURPLUS LABOR IN AGRICULTURE (1967-72)

(Adults of both sexes*)

Years	Demand '000'	Supply '000'	Surplus in numbers '000'	Surplus in %
1967	9,173	10,083	910	9.0
1970	9,680	10,143	463	4.8
1972	10,025	10,138	113	1.1

*This note is added by the author.

Source: Ref. 6, p.149, Table 66.

Two different sets of seasonal surplus estimates are made. Under the first, a 45 hour work week was assumed for all seasons. Under the second, the number of days available

for agricultural work were estimated for each of the five seasonal periods on the basis of climatic conditions (6, 57, 26, 53 and 73 days respectively).

The first estimate (a), gives a very high surplus for the slack season. This high surplus estimate does show the unutilized labor potential, but it does not show the seasonally removable surplus. Unfortunately, the SFYP publishes only these high surplus estimates, and presents them in such a careless fashion that the reader is mislead into taking them as the surplus available for work in other areas for the entire slack season. In fact, only the second estimate, i.e., estimate (b), shows specifically the seasonally removable surplus, but this set of figures does not appear in the SFYP.5/ See Table 5 for the results of both assumptions (a) and (b).

TABLE 5

SURPLUS LABOR IN AGRICULTURE

By Seasons, 1967-72

(adults of both sexes*) (in thousands)

Seasonal Periods	1967		1972	
	a.	b	a	b
1. Dec.-Feb.	7,800	1,529	7,686	1,072
2. March-May	5,658	4,734	5,513	4,576
3. June	5,654	5,654	5,129	5,129
4. July-Aug.	910	910	113	133
5. Sept.-Nov.	5,358	5,139	4,886	4,640

Source: Ref. 6, p.147, Table 63.

Note: The estimates (b) are calculated by the author from the same table.

*This explanation is added by the author.

We have indicated above (Table 4) the peak season surpluses. These figures can be taken as an index of the year round removable surpluses. By manipulating the above

figures it is possible to generate more information from these estimates. Firstly, by reducing the peak season surplus from the estimate (b) for each season, we can get an index of the seasonally removable surplus, i.e., this surplus group may be made available for seasonal work in other areas, assuming perfect mobility. (See Table 6).

TABLE 6

NET SEASONALLY REMOVABLE SURPLUS IN AGRICULTURE
(1967-72)

(Adults of both sexes) (in thousands)

Seasonal Period	1967	1972
1. Dec.-Feb.	619	959
2. March-May	3.824	4.463
3. June	4.744	5.016
4. July-Aug.	0	0
5. Sept.-Nov.	4.229	4.523

Source: Table 5 above.

Secondly, by subtracting the estimate (b) from estimate (a) we can readily get an estimate of the number of people seasonally unemployed in rural areas but not removable. (See Table 7).

TABLE 7

NET SEASONALLY UNEMPLOYED BUT NOT REMOVABLE SURPLUS
(1967-72)

(Adults of both sexes) (in thousands)

Seasonal Period	1967	1972
1. Dec.-Feb.	6.271	6.614
2. March-May	924	937
3. June	0	0
4. July-Aug.	0	0
5. Sept.-Nov.	219	246

Source: Table 5 above.

Again, we would like to indicate that the above figures are merely an index of e relevant surplus groups, and should not be taken as th absolute surpluses. Since the number of possible working days in agriculture underlying the estimate (b) are generally very low, the seasonally removable surpluses above can be taken as a minima. For the same reason, the figures for the unremovable seasonally unemployed constitute the upper bound of the estimate for this group.

Assuming perfect mobility and almost perfect divisibility of household labor, the surplus agricultural labor in 1967, as indicated in the SFYP, can be broken down as follows:

1. A 9 per cent removable surplus during the busiest season;

2. As a maximum another 47 per cent surplus seasonally available for work in other sectors and areas during the June slack period. The same type of seasonal surpluses are also available at other off-peak periods, though at lower percentage levels.

3. Finally, a maximum of 52.3 per cent surplus available for work in non-agricultural activities in the rural areas during the December-February slack period. (See Table 8).

TABLE 8

SEASONAL TOTAL SURPLUS LABOR IN AGRICULTURE
(1967-72)

(Adults of both sexes) Seasonal Periods	(as % of total supply of labor*) 1967		1972	
	a	b	a	b
1. Dec.-Feb.	77.4	15.2	75.8	10.6
2. March-May	56.1	47.0	54.4	45.1
3. June	56.1	56.1	50.6	50.6
4. July-Aug.	9.0	9.0	1.1	1.1
5. Sept.-Nov.	53.1	51.0	48.2	45.8

*SFYP assumes year round fixed supply figures 10,083,000 for 1967; and 10,138,000 for 1972.

Source: Table 5 above.

III. DATA AND METHODOLOGY

The methodology for the agricultural employment and surplus estimates of the SFYP incorporates both direct and indirect elements. The direct measurements regarding the labor and manpower requirements of each operation for each crop were made in the field, i.e., in the Antalya Region of Turkey, by FAO and Turkish experts in 1963. Supplementary data has been collected from interviews with the owners of agricultural holdings and peasants occupied in cultivation; and through sending questionnaires to the agricultural extension personnel working in the region.6/ All the centrally available indirect data sources have also been tapped e.g., national figures for production, areas sown and harvested, numbers of livestock, tractors etc.

The labor and power requirements coefficients derived from the Antalya studies have been checked against new data derived from a special survey of selected county extension service personnel in all regions of Turkey. Only minor modifications of the original coefficients are necessary when the derived magnitudes are compared with the national results.

On the basis of all this information, the necessary agricultural operations, e.g., planting seed beds, first ploughing, second ploughing, third ploughing, dragging, transplanting, etc., were identified and listed for each crop. The most important factor determining the labor time required is the power source (each type of animal and machine power), and the power capacity of each of these sources is estimated. Power requirements for each of the operations are first calculated on the assumption of a standard horse-pair and of standard equipment. The power capability of a standard horse in Turkey is estimated on the basis of the live weight of the animal and the feeding conditions (the same power capability estimates are also made for oxen, bullocks, and mules). The estimates of labor and power requirements for each operation are then expressed in terms of crew time. The characteristics of equipment and implements used for each of the agricultural operations are also fully considered in the derivation of the above mentioned estimates.

The following formula is used for this purpose:

For each operation work done per 'crew hour' (in m^2 per hour)	=	Ratio of actual net working time to gross working time (in % of one gross hour)	x	Net width of the equipment used (in cm.)	x	Net speed of the crew (in m. per hour)

From the point of view of power source, the above mentioned labor and power requirement coefficients give us the performance rate coefficient of that particular power source relating to a certain agricultural operation. Within the limits of the available information, these coefficients also reflect many other relevant conditions.

In fact, the use of the above mentioned formula explicity allows for the various conditions such as the work habits of the farmers, their pace, soil conditions and the type of culture, i.e., dry or irrigated, length and width of plots, loss of time due to maintenance of the crew on the field, work breaks of the farmers, etc. At a later stage, adjustments are made to the initial estimates to allow for power sources other than the standard horse, and for equipment other than the ordinary metal plough. Labor requirements for each operation are not invariably computed in terms of "work hour equivalent of an adult male". On the contrary, the work is assumed to be done by the person who normally performs that operation in Turkey. This may be a male or female adult, an elder, or a child. On the basis of this standard crew, together with its flexible human agent, the labor and power requirements for each operation are estimated in four different ways:

a. Hours required per hectare for those operations referring to area worked, e.g., ploughing, raking, etc.

b. Hours required per ton or per kilogram for those operations referring to the weight of crop processed, e.g., threshing, hauling, weighing, sacking, etc.

c. Hours required per hectare and also per ton or kilogram for those operations relating both to area worked and to yield per hectare, e.g., harvesting of cereals, cotton, etc.

d. For certain special operations like application of fertilizers, spraying of pesticites, etc., hours per hectare and per kilogram of input consumed are estimated.

For (c) and (d), the formula $Y = a+bx$ is used. Here, Y = hours of crew time, a = area, b = constant, x = yield per hectare or input applied per hectare.

"Crop production and area" figures at the national level are applied to each set of operations listed under the name of each crop.7/ Labor and power requirements for the special operations like fertilizer application and pesticites spraying, are estimated on the basis of the total consumption of these inputs without specifying the crops for which they are actually used.

Certainly, the combinatioh and sequence of operations for the same crop may differ from region to region, as well as with time. However, in the works of the State Planning Organisation, one single standard combination is used for each one of the crops throughout the years. Considering the fact that each of those different possible combinations would constitute a different production technology, the studies of the SPO in this respect have implicitly assumed one single standard and constant technology for each crop.

The sum total of the labor requirements computed on the basis of "operation coefficients" and the national level "crop production and area" figures are then corrected for the deviations from this standard crew. Furthermore, (as explained above) for special operations like the use of fertilizers and pesticites etc., adjustments are made to the total labor hours required.

The base year for the first SPO study was 1963. In order to obtain labor requirements for each crop for the other years, adjustments were made to the requirement estimate of the base year for the changes in production, area, and other crucial factors. These crucial factors are distribution and power capacity of power sources, number and types of equipment and implements, the amount of fertilizer and pesticite consumed, the area of irrigated land. The original performance rate coefficients of each power source for each operation have not been altered. Instead, some simple indexes have been introduced to allow for the projected changes in the power source composition.

Livestock labor requirements have been estimated on the basis of "number of animals per worker per day" for 1963. These livestock ratios have also been kept constant for all other years. Considering the primitive character of the livestock sector in the country this assumption is quite reasonable.

Assuming an 8 hour working day both for crop and livestock production, labor requirements of the two groups of activities were presented in the first study of the SPO in terms of the number of days of employment for the independently estimated supply of labor in agriculture.8/ (See Appendix Table I and II).

The second study of the SPO used exactly the same methodology and the same performance rate coefficients. In this study, the seasonal period of each operation was specified. This has made the computation of seasonal labor requirements possible for the years 1967 and 1972.

In this work, the above mentioned allowances were again made regarding changes in the crucial factors. A special feature of this study was that improved feeding of animals was projected for the period 1967-72. As a result, an increase was assumed both in the power capacity of work animals and in the yield of meat and milk animals.

IV. CORRECTED GLOBAL RESULTS

In the pages above, we have reviewed the surplus labor estimates of the First and Second Five Year Plan, and explained the data and methodology of the two studies by the State Planning Organisation. Now, we would like to present some global comparisons derived from the same studies, for the 1962-72 period. For this purpose, we made some adjustments to the 1962 estimates.9/

Adjusted series show an approximately 3 per cent yearly productivity increase for the 1962-72 period. This productivity increase is implicit in the SPO's labor requirement estimates, and it does not reflect the actual situation in agriculture. However, to our judgement it indicates that the SPO's requirement estimates are reasonable. (See Table 9).

TABLE 9

VALUE OF GROSS PRODUCT PER MAN HOUR IN AGRICULTURE AND ITS INDEX

(Turkish Lira* at 1965 prices)

Year	Value			Index			
	Crop (1)	Livestock (2)	Total (1)+(2)	Base Year	Crop (1)	Livestock (2)	Total (1)+(2)
1962	3.00	2.09	2.63	-	-	-	-
1967	3.59	2.26	3.02	(1962=100)	119.5	108.1	114
1972	4.09	2.64	3.48	(1967=100)	114.1	116.7	115

*Official rate: 9 TL. = U.S.$ 1

Source: See Appendix Tables IV and V.

On the other hand, the projected Value of Gross Product shows a steady increase, while the estimated total labor requirement declines for 1962-67 and rises again for 1967-72. (See Table 10).

TABLE 10

INDICES OF PROJECTED VALUE OF GROSS PRODUCT AND ESTIMATED TOTAL LABOR HOURS REQUIRED IN AGRICULTURE

Period	Value of Gross Product	Total Labor Hours Required
1962-67	114.3	99.5
1967-72	124.8	108.5

Source: Appendix Tables IV and V.

The labor requirement estimates for 1967 in the above calculations are based on projections made in 1965 and we did not adjust them according to the actual figures for that year. However, the over-estimation in the labor requirement estimates for 1967 due to this change is quite small.10/

For the peak period, our own labor supply estimates and the SFYP employment estimates indicate that the surplus at the peak is not going to diminish in the 1967-72 period. In fact, it remains almost at the same level as in 1967. (See Table 11).

TABLE 11

PEAK PERIOD SUPPLY AND REQUIREMENT AND SURPLUS LABOR IN AGRICULTURE, 1967-72

(Adults of both sexes)

Year	Labor Supply* ('000')	Labor Required ('000')	Surplus ('000')
1967	11,689	9,173	2,516
1972	12,311	10,025	2,286
1967-72 change	105.3%	109.3%	90.9%

*Under assumption B.

Source: See Appendix Tables XI and XII.

V. OWN ESTIMATES OF SEASONAL SURPLUS

As explained above, only the second SPO study (1967-72) allows for seasonal estimates of required labor in agriculture. We have found these estimates highly satisfactory. Therefore, we adopted them without any adjustment.

On the supply side the estimates proved to be very inadequate, and we have prepared estimates of our own.11/ For this purpose, we have calculated an index of agricultural employment on the basis of seasonal total man hour requirement estimates of the second SPO study. (See Appendix Table VI). Then, we computed a seasonality index of non-agricultural activities from the data published by the Workers Insurance Institute. By comparing these two indices we obtained an "index of relative pressure toward urban employment" for 1967. (See Table 12).

TABLE 12

LABOR MOVEMENT IN AND OUT OF AGRICULTURE AND SEASONALITY INDEX, 1967

(Based on Average Monthly Total of Man Hours required in Agriculture and Monthly Total Man Days Paid for in Non-Agriculture)

(Mean Month = 100)

Seasonal Periods	Agriculture (1)	Non-Agriculture (2)	Index of relative pressure towards urban employment (2)÷(1)	Movement
1. Dec.-Feb.	51.4	83.8	163.0	Push
2. March-May	95.1	97.0	102.0	Neutral
3. June	93.0	125.5	135.0	Pull to urban
4. July-Aug.	189.5	109.2	57.6	Pull back to rural
5. Sept.-Nov.	97.5	104.5	107.2	Neutral
Mean Month	100.0	100.0	100.0	

continued Table 12

Source: For column (1) see, Appendix Table VI; for column (2), Workers Insurance Institute, Yearly Statistical Bulletin. (Note: Workers Insurance Institute covered 30 per cent of all the wage and salary earners in Turkey in 1965).

This index served us as an indicator of possible seasonal changes in the supply of agricultural labor. On this basis we have prepared our supply estimates.

We have used the population censuses of 1955, 1960 and 1965 as a starting point. Unlike the previous supply estimates we have included the age group 6 to 14, and entirely excluded the rural population sub-group whose economic activity is unknown in the census books. The latter, actually contains mostly the armed forces and gendarme.12/

Furthermore, we expanded the supply of adults at the July-August Peak by 6 to 7 per cent and reduced it by about 15 per cent in the September-November, March-May periods and by 30 per cent during the December-February slack season. These seasonal reductions imply that we lower the adult female labor force participation rate from 83 per cent at the peak period to 58 and 34 per cent levels respectively for the slack seasons mentioned above. Similar variations were allowed for in the 6 to 14 age group.

As explained above, both in the First and Second SPO studies, labor requirement estimates were not calculated in terms of the adult male equivalent. On the contrary, the customary practices of farmers were fully adhered to, e.g., computing the adult female hours required for those jobs usually done by women.13/ Therefore, our requirement estimates are basically in terms of adults of both sexes, and even some children's work was allowed.

Parallel to this, our supply estimates are arranged by adults of both sexes, and to be on the safe side, children are included into the total on a 1 child worker = 0.5 adult worker basis. Moreover, the male/female ratio implicit in our supply estimates is well above the required level.

By making different assumptions about the degree of expansion and contraction in the seasonal supply of labor three sets of supply estimates are computed for 1972.14/ The results are presented in the Appendix Tables IX and X.

Two other important aspects of the supply question are the number of available days for agricultural work in each season, and the number of working hours per working day. In the second SPO study the former was assumed to be only 215 days per year. This figure is 15.7 per cent lower than the figure accepted in the Greek Study.15/ Although this figure is a minimum we did not make any adjustment for it. Therefore, our seasonal surplus figures can be taken as very conservative estimates. As to the average working hours per day, the second SPO study assumes only 7.5 working hours per day (and 6 working days a week) for crop production. This way it allows for the commuting time requirements which are not included in the total labor requirement estimates.16/ In fact, gross working hours per day, especially in the busy season, are not less than 10 hours.

After explaining the general characteristics of our surplus labor estimates, we can now present the results obtained.

Assuming a moderate expansion in supply at the peak period, a comparison of our own supply figures with the labor requirement estimates of the SFYP indicates a seasonal surplus that varies between 2.5 and 6.6 million people. Under the assumption of only six working days per week during the December-February period, a deficit is indicated by these figures. In our judgement, this merely indicates that this '6 working days per week' assumption is unrealistically low. (See Table 13).

Of course, these figures do not indicate the removable surpluses because of the indivisibility of labor and the obstacles to perfect mobility. On the other hand, undoubtedly these national averages do conceal large surpluses for some regions and deficits for others.

TABLE 13

SEASONAL AGRICULTURAL SURPLUS LABOR
(1967-72)

(adults of both sexes) (in thousands)

Seasonal Period	1967 B - a	1967 B - b	1972 B - a	1972 B - b
1. Dec.-Feb.	4,978	-1,198	5,046	-1,568
2. March-May	4,728	3.804	4,881	3,944
3. June	6,617	6,617	6,505	6,505
4. July-Aug.	2,516	2,516	2,286	2,286
5. Sept.-Nov.	4,428	4,209	4,254	4,008

a: assuming a year round 45 hours per week work pattern for crop production.

b: assuming the number of working days for crop production are as follows: 6, 57, 26, 53 and 73 respectively, for the five seasonal periods.

B: assuming only a moderate, i.e., 6 to 7%, expansion in the supply of labor during the peak period.

Source: Appendix Tables XI and XII.

In order to indicate the surplus more clearly we made another set of computations. This time we simply divided the total labor hours required by the labor supply figures, on a weekly basis. By this, we avoided making complicated assumptions about the length of the working day and the number of days available for agricultural work during each season.17/

The results indicated that in 1967 the seasonal work weak ranged between 17 to 40 hours, and the weighted annual average "work required per adult farmer" is 25 to 26.3 hours per week. No appreciable improvement is indicated for 1972.

TABLE 14

HOURS WORKED PER WEEK (ESTIMATE), 1967-72

Seasonal Period	1967 A	1967 B	1967 C	1972 A	1972 B	1972 C
1. Dec.-Feb.	16.8	16.8	16.8	17.5	17.5	17.5
2. March-May	24.2	24.2	25.3	24.4	24.4	25.5
3. June	20.1	20.1	20.8	21.7	21.7	22.5
4. July-Aug.	34.9	37.3	39.5	35.7	38.2	40.8
5. Sept.-Nov.	25.1	25.1	26.2	26.8	26.8	28.0
Weighted Mean Month	25.0	25.4	26.3	26.0	26.4	26.9

Source: Appendix Tables VI and IX.

The November 1967, SIS, Labor Force Household Survey covering the urban areas, i.e., places with 50,000 or more inhabitants, shows a 42.8 hour net work week for agriculture.18/ Assuming that a 43 hour week for agricultural and non-agricultural activities is possible and normal in rural areas the surplus labor is computed in terms of idle hours in a week, during each season. (See Table 15). (For idle hours see Appendix Table XIII).

VI. CONCLUSION

The idle portion of the farmers' total available working time was estimated to be about 40 per cent for all Turkey in 1967.

As a conservative estimate we can say that the peak season surplus was 13 per cent and during the slack season this went up to 61 per cent in 1967.

Furthermore, there are no signs of improvement in the situation for 1972.

TABLE 15

SURPLUS LABOR BY SEASONS* 1967-72

(Percentages)

Seasonal Period	1967 A	1967 B	1967 C	1972 A	1972 B	1972 C
1. Dec.-Feb.	60.9	60.9	60.9	59.3	59.3	59.3
2. March-May	43.7	43.7	41.2	43.3	43.3	40.7
3. June	53.3	53.3	51.6	49.5	49.5	47.7
4. July-Aug.	18.8	13.2	8.1	17.0	11.2	5.1
5. Sept.-Nov.	41.6	41.6	39.1	37.0	37.0	34.9
Weighted Mean month	41.9	40.9	38.8	39.5	38.6	37.4

* Expressed in terms of the ratio of idle hours per week on the basis of a full agricultural work week of 43 hours.

Source: Appendix Table XIII.

For further study on this issue and for planning activities in agriculture the following points seem to have considerable inportance:

a. Indirect studies provide a valuable insight into the problem of employment in agriculture. However, with the existing data, these studies can only give a broad picture of the surplus labor issue. In order to produce the kind of estimates that would serve as a basis for policy decisions, a farm management survey is needed. The latter is especially needed for obtaining information on the urban employment opportunities the farmers seasonally need. Regionality also must be introduced in the next surplus labor study.

b. As the concepts of employment and unemployment lose their meaning in a rural setting, this type of indirect study is indispensable.

c. The problem of production in agriculture should be considered together with the problems of providing employment and generating income in the rural areas.

APPENDIX

TABLE I

EMPLOYMENT AND SURPLUS LABOR IN AGRICULTURE, BY SEASONS (1967)

(Adults of both sexes*) (in thousand)

Seasonal Periods	Employment					Surplus**	
	Crops(a)	Crops(b)	Livestock	Total(a)	Total(b)	a	b
Dec.-Feb.	520	6,691	1,763	2,283	8,454	7,800	1,529
March-May	2,410	3,334	2,015	4,425	5,349	5,658	4,734
June	2,428	2,428	2,001	4,429	4,429	5,654	5,654
July-Aug.	7,435	7,435	1,738	9,173	9,173	910	910
Sept.-Nov.	3,195	3,414	1,530	4.725	4,944	5,358	5,139

* is added by the author.
**year round fixed supply of 10,083,000 people were assumed for 1967.

TABLE II

EMPLOYMENT AND SURPLUS LABOR IN AGRICULTURE, BY SEASONS (1972)

(Adults of both sexes*) (in thousand)

Seasonal Periods	Employment					Surplus**	
	Crops(a)	Crops(b)	Livestock	Total(a)	Total(b)	a	b
Dec.-Feb.	558	7,172	1,894	2,452	9,066	7,686	1,072
March-May	2,442	3,378	2,184	4,625	5,562	5,513	4,576
June	2,829	2,829	2,180	5,009	5,009	5,129	5,129
July-Aug.	8,095	8,095	1,930	10,025	10,025	113	113
Sept.-Nov.	3,601	3,847	1,651	5,252	5,498	4,886	4,640

* is added by the author.
**year round fixed supply of 10,138,000 people were assumed for 1972.

TABLE III

LABOR AND POWER REQUIREMENT COEFFICIENTS COVERING BASIC OPERATIONS OF MAIN CROPS, 1963

	Per unit work hour per adult worker of both sexes		Per unit work hour for a standard horse pair	
	Per Hectare	Per Ton	Per Hectare	Per Ton
Fallow	33.6	-	33.6	-
Wheat, spelt, canary seed	141.4	150.1	81.2	72.6
Maize, millet, sun-flower	201.9	187.8	81.9	22.6
Barley	141.4	134.5	81.2	57.6
Rye	134.4	165.9	81.2	92.6
Oats	134.4	141.2	81.2	60.1
Mixed grains	141.4	139.5	81.2	62.6
Paddy	8.74	4.72	7.44	.94(tractor power)
Pulses, wild vetch, (seeds), soybeans	183.9	130.5	80.2	47.3
Cow vetch (hay)	121.9	19.7	80.7	5.7
Alfalfa (hay)	164.8	18.5	-	5.7
Establishing Alfalfa stand	99.6	-	89.6	-
Hemp (Fibre)	350.0	960.0	90.0	22.6
Hemp (Seed)	-	160.0	-	4.0
Flax (Fibre)	225.0	1025.0	81.4	22.6
Flax (Seed)	-	143.0	-	4.0
Cotton (Fibre)	242.1	121.6	16.4	3.1(tractor power)
Cotton (Seed)	-	121.6	-	3.9 " "
Tobacco	1102.0	600.0	116.0	4.4
Sugar-Beet	575.7	31.1	75.7	13.4
Opium (Gum)	561.2	80.0(per kg.)	81.2	-
Opium (Seed)	-	365.4	-	5.4
Anise	81.2	160.0	81.2	15.6

continued....

Table III, continued

	Per unit work hour per adult worker of both sexes		Per unit work hour for a standard horse pair	
	Per Hectare	Per Ton	Per Hectare	Per Ton
Rose (Oil)	206.0	208.0(Per kg.)	11.0	8.0(per kg.)
Tea	500.0	463.0	20.0	8.0
Sesame, Rape seed Safflower	151.7	143.0	81.4	4.0
Peanuts (Ground nuts)	321	249	9.01	3.0(tractor power)
Potatoes, onion	490.9	31.7	110.9	4.7
Garlic, vegetables	578.1	79.7	95.6	4.7
Melons, water melons	237.1	15.4	97.1	7.7
Citrus fruits	416.0	28.0	91.0	8.0
Bananas	446.0	24.0	6.0	18.0
Olives	101.0	44.4	11.0	8.0
Figs	200.0	36.0	55.0	8.0
Apples, pears	256.0	28.0	66.0	8.0
Stone fruits, mulberry	169.6	36.0	45.6	8.0
Grapes	496.0	19.0	96.0	8.0
Pistachios, hazelnuts	25.0	250.0	66.0	8.0
Almonds	26.0	157.3	6.0	8.0
Walnuts	26.0	80.0	6.0	8.0
Chestnuts	26.0	120.0	6.0	8.0

Source: Ref. No.7.

TABLE IV

VALUE OF GROSS PRODUCTS IN AGRICULTURE

(million TL, at 1965 prices)

Year	Crop (1)	Livestock (2)	Total (1)+(2)	Index for the Total Base	Index for the Total Index
1962	21,912	10,465	32,377	-	-
1967	25,211	11,794	37,005	1962=100	114.3
1972	31,301	14,886	46,187	1967=100	124.8

Source: Columns (1) and (2), Second Five Year Plan, p.354, Table 160 and p.366, Table 167.

TABLE V

REQUIRED LABOR INPUTS (ESTIMATES)

(Million Man Hour per Day)

Year	Crops (1)	Livestock (2)	Total (1)+(2)
1962	7290.9	5001.6	12292.5
1967	7026.9	5208.6	12235.5
1972	7645.7	5635.4	13281.1

Source: Columns (1) and (2), Unpublished Background Documents of the Second Five Year Plan.

TABLE VI

SEASONAL BREAKDOWN OF REQUIRED LABOR INPUTS (ESTIMATE)

(Million Man Hours)

Seasonal Period	Period Totals of Man Hours Required			Seasonality Index*	
	1967 (1)	1972 (2)	Weights (3)	1967 (4)	1972 (5)
Dec.-Feb.	1,570.7	1,686.9	1/3	51.4	50.8
March-May	2,907.9	3,051.4	1/3	95.1	91.9
June	948.5	1,069.0	1/1	93.0	96.6
July-Aug.	3,865.3	4,165.4	1/2	189.5	188.2
Sept.-Nov.	2,983.1	3,308.5	1/3	97.5	99.6
Total	12,235.5	13,281.1			
Weighted Mean Month	1,019.6	1,106.8	1/2	100.0	100.0

*Based on average monthly total of man hours required as a percentage of the weighted mean month.

Source: For columns (1) and (2) see Second S.P.O. Study on Surplus Agricultural Labor (Unpublished material).

TABLE VII

GUIDE TO SEASONAL SUPPLY ADJUSTMENT 1967

A:High expansion B:Moderate expansion C:No expansion during the busy season		Permanent Agricultural Labor Force		Seasonal Agricultural Labor Force	
		15 +	6-14	15 +	6-14
1967 A)	1.Dec.-Feb.	- 29.2%	- 100%	0	0
	2.March-May	- 14.6%	- 50%	0	0
	3.June	0	0	0	0
	4.July-Aug.	(10.261.000)	(1.575.000)	(+6.2%)	(+101.6%)
	5.Sept.-Nov.	- 14.6%	- 50%	0	0
1967 B)	1.Dec.-Feb.			0	0
	2.March-May			0	0
	3.June	All same as 1967 A.		0	0
	4.July-Aug.			Either "0" or(+6.2%)	Either (+101.6%) or "0"
	5.Sept.-Nov.			0	0
1967 C)	1.Dec.-Feb.			0	0
	2.March-May			0	0
	3.June	All same as 1967 A.		0	0
	4.July-Aug.			0	0
	5.Sept.-Nov.			0	0

TABLE VIII

COMPUTATION OF LABOR SUPPLY ESTIMATE IN AGRICULTURE
(UNDER ASSUMPTION A) YEAR 1972

	Permanent		Seasonal		Total-Supply
	15 +	6-14*	15 +	6-14*	(adults of both sexes)
1. Dec.-Feb.	7,498	0	0	0	7,498
2. March-May	9,098	816	0	0	9,506
3. June	10,698	1,632	0	0	11,514
4. July-Aug.	10,698	1,632	797	1,721	13,171
5. Sept.-Nov.	9,098	816	0	0	9,506
Weighted Mean Month					9,825

* 1 child = 0.5 adult

Source: Based on 1955, 1960 and 1965 Population Censuses and author's own computations.

TABLE IX

SEASONAL SUPPLY OF AGRICULTURAL LABOR FORCE, 1967-72

(In adult equivalents of both sexes) (In thousands)

Seasonal Period	1967			1972		
	A	B	C	A	B	C
1. Dec.-Feb.	7,261	7,261	7,261	7,498	7,498	7,49
2. March-May	9,153	9,153	8,761	9,506	9,506	9,09
3. June	11,046	11,046	10,653	11,514	11,514	11,10
4. July-Aug.	12,489	11,689	11,046	13,171	12,311	11,51
5. Sept.-Nov.	9,153	9,153	8,761	9,506	9,506	9,09
Weighted M. Month	9,409	9,273	8,936	9,825	9,679	9,481
Mean-Month Index (A = 100)	100	98.5	95.0	100	98.5	96.5

Source: Population Censuses of 1955, 1960 and 1965, and the assumptions of the author, partly explained in Table VII and VIII

TABLE X

SEASONAL VARIATIONS IN THE SUPPLY OF AGRICULTURAL LABOR ESTIMATE, 1967-72

(As a percentage of weighted mean-month total)

Seasonal Period	1967			1972		
	A	B	C	A	B	C
1. Dec.-Feb.	77.2	78.3	81.3	76.3	77.5	79.1
2. March-May	97.3	98.7	98.0	96.8	98.2	96.0
3. June	117.4	119.1	119.2	117.2	119.0	117.1
4. July-Aug.	132.7	126.0	123.6	134.1	127.2	121.4
5. Sept.-Nov.	97.3	98.7	98.0	96.8	98.2	96.0
Weighted M. Month	100	100	100	100	100	100
Mean-Month Index (A = 100)	100	98.5	95.0	100	98.5	96.5

Source: Table IX.

TABLE XI

SEASONAL AGRICULTURAL SURPLUS LABOR, 1967

(Adults of both sexes) (In thousands)

Seasonal Periods	Supply	Total Employment		Surplus	
	B	a*	b**	B-a	B-b
1. Dec.-Feb.	7,261	2,283	8,454	4,978	-1,193
2. March-May	9,153	4,425	5,349	4,728	3,804
3. June	11,046	4,429	4,429	6,617	6,617
4. July-Aug.	11,689	9,173	9,173	2,516	2,516
5. Sept.-Nov.	9,153	4,725	4,944	4,428	4,209
Weighted Mean Month	9,273				
SFYP Supply Figure	10,083				

* Assuming the seasonal number of working days are as follows:

continued, Table XI

6, 57, 26, 53 and 73 for crop production; and 8 hours per day for livestock production.

** Assuming a 45 hours work week for all seasons for crop productio: and the same as above for livestock.

Source: SFYP, p.147, Tb. 63 and Table IX.

TABLE XII

SEASONAL AGRICULTURAL SURPLUS LABOR, 1972

(Adults of both sexes) (In thousands)

Seasonal Period	Supply B	Total Employment a*	Total Employment b**	Surplus B-a	Surplus B-b
1. Dec.-Feb.	7,498	2,452	9,066	5,046	-1,568
2. March-May	9,506	4,625	5,562	4,881	3,944
3. June	11,514	5,009	5,009	6,505	6,505
4. July-Aug.	12,311	10,025	10,025	2,286	2,286
5. Sept.-Nov.	9,506	5,252	5,498	4,254	4,008
Weighted Mean Month	9,679				
SFYP Supply Figure	10,138				

* Assuming the seasonal number of working days are as follows: 6, 57, 26 and 73, for crop production and 8 hours per day for livestock.

** Assuming a 45 hours work week for all seasons for crop productio: and thh same as above for livestock.

Source: SFYP, p.147, Tb. 63 and Table IX.

TABLE XIII

SURPLUS LABOR BY SEASONS, 1967-72

(i.e., the Number of Idle Hours per Week)

Seasonal Period	1967			1972		
	A	B	C	A	B	C
1. Dec.-Feb.	26.2	26.2	26.2	25.5	25.5	25.5
2. March-May	18.8	18.8	17.7	18.6	18.6	17.5
3. June	22.9	22.9	22.2	21.3	21.3	20.5
4. July-Aug.	8.1	5.7	3.5	7.3	4.8	2.2
5. Sept.-Nov.	17.9	17.9	16.8	16.2	16.2	15.0
Weighted M. Month	18.0	17.6	16.7	17.0	16.6	16.1

Source: Table 14.

FOOTNOTES

1/ See reference list item No.5, p.400, Tables 352-353 and item No.6, p.147-148, Tables 63-64. We would like to correct the 9.9% figure that appears in the SFYP (p.148, Table 64) for 1967, as 9%.

2/ Ref. No.4 and 1.

3/ For an excellent survey of the relevant literature, though somewhat outdated, See Ref. No.2.

4/ Ref. No.7. This work was done by the U.N. expert Dr. Russel Shaw, and SPO expert Mr A. Tongul.

5/ In the SFYP (see p.147, Table 63, Footnote) it is indicated that "The analysis essential for manpower demand is made separately for the different agricultural regions". This is not quite so. The truth is that the labor demand estimates were prepared at the national level, taking into account, at each step, weighted regional differences in the character of agricultural activities.

6/ FAO, Pre-Investment Surveys of Antalya Region, Turkey (1963), Vol. I and II, Rome, 1966.

7/ For the labor and power requirement coefficients, covering basic operations of main crops, see Appendix Table III.

8/ Livestock workers were assumed to work 7 days a week, in order to convert the man year labor requirement estimate into man day employment estimate.

9/ One of the adjustments was for the hours worked per day (8 hours in 1962 and 7.5 in 1967-72), and the other one was for the crop production and area figures (in 1962 State Institute of Stats. figures and SPO figures in 1967-72). Our adjustments made the 1962 estimate comparable with that of 1967-72.

10/ 1967 actual gross product is 5.6 per cent down, i.e., 34,920 million TL. in 1965 prices vs. the projected figure of 37,005 million TL. Most of the change was due to under-realization of expected yields. This makes our labor requirement estimates only about 2.5 per cent over estimated.

11/ In both the supply and requirement sides, the forestry, fishing and hunting sub-sector is excluded. However, this sub-sector contains only 0.5 per cent of the agricultural labor force. See 1962 Population Census, p.548.

12/ Misjudging its content, the First SPO Study included a part of this sub-group of rural population in the agricultural labor supply estimate. See Ref.7, p.13, footnote a.

13/ In Ref.6. Dr O. Türkay assumes that the adult male work hour equivalent was used used in all the estimates of labor requirement, and builds his case upon this misunderstanding.

14/ These assumptions are: A:a 12% high expansion; B:a 6% medium expansion; and C: no expansion, during the busy season, and some other assumptions of contraction for other seasons. For detail, see Appendix Tables VII and VIII.

15/ See Ref. 3, p.103.

16/ In Ref. 6, Dr O. Türkay disregards this points and makes an unnecessary 15% addition to total labor requirement for commuting time. The same mistake is made in the SPO document itself. (See Ref.7). On this issue see Ref.3, p.108.

17/ This way, the results do not indicate what portion of the surplus labor is removable, but due to the weak foundations of the above mentioned two assumptions which are employed in the former results, they also have very little informative value as to the removable part of the surplus.

18/ See p.34-35, Tables 11, 11A, Average is computed by the author.

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PROSPECTS FOR INCREASING EMPLOYMENT IN THE INDIAN MANUFACTURING SECTOR

Dr. S.V. Sethuraman*

I. Introduction
II. Growth of Employment in the Indian Manufacturing Sector, 1950-64
III. The Structure of the Indian Manufacturing Sector
IV. Econometric Investigation of Employment in Manufacturing
V. Policy Implications and Conclusions
VI. Summary
VII. Appendix
VIII. Footnotes

"On a close assessment of the various programmes under implementation, one invariably comes to the conclusion tnat the efforts made at employing surplus manpower today are not systematic but sporadic. No attempt appears to have been made to get a complete picture, in perspective, of the problem of unemployment.....It is regrettable that the past plans have consistently neglected to make good use of labour resources. Successful utilisation of manpower resources should be the key-note of future planning."

V.V. Giri

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I. INTRODUCTION

The large scale manufacturing sector in India, defined to include all factories, 1/ contributed 8.3 per cent to the net domestic product in 1964-65 in contrast to 5.8 per cent by the small scale manufacturing sector comprising other small manufacturing units. 2/ The large scale manufacturing sector is estimated as employing approximately Rs.40 billion of capital and 4.5 million workers and generated about Rs.17 billion worth of net product in the economy in 1964. 3/ In terms of employment, large scale manufacturing offered employment opportunities to only 2 per cent of the 187 million work force in contrast to over 7 per cent employed by small scale manufacturing.

The net domestic product (at 1960-61 prices) generated by the large scale manufacturing sector increased from Rs.10.7 billion in 1960-61 to Rs.15.4 billion in 1964-65, which implies a rate of growth of 9.5 per cent per annum. The net domestic product (NDP) in small scale manufacturing, however, showed an increase of only 6.5 per cent per year during the same period. 4/ Thus, large scale manufacturing showed a faster rate of growth of NDP. On the other hand, the employment of labor and capital, measured in terms of compensation to these inputs at current prices, in this sector grew at 5.7 and 27 per cent, respectively, between 1960 and 1964. These figures show that the rate of growth of employment of labor in recent years was much smaller relative to that of capital, even if we adjust for a rise in price of capital goods. The net product originating from public sector manufacturing increased from Rs.231 million in 1960-61 to Rs.1.049 billion in 1964-65 (both measured at current prices) which implies a rate of growth of about 35 per cent per year. Correspondingly, the employment opportunities offered by this sector increased at 15 per cent per annum during the same period.

1/ See footnotes at end of article.

The above discussion points out two facts

1. the large scale manufacturing output grew at a faster rate in relation to the output from the small scale manufacturing sector; within the large scale manufacturing sector, public sector manufacturing showed a rapid growth of output; and

2. the rate of growth of employment in the large scale manufacturing sector lagged behind the rate of growth of output from this sector (vis-a-vis the capital employed per worker rose rapidly).

In the present paper an attempt is made to analyze the underlying process and identify the forces that were responsible for the above phenomenon. It is hoped that the knowledge thus gained will be useful in determining the future employment prospects in this sector.

Owing to constraints on the availability of data, the present study is based on the "Census Sector" of large scale manufacturing only. 5/ The data are collected from the factories every year on a complete enumeration basis and the same are published by the Industrial Statistics Wing of the Central Statistical Organization of the Government of India.

II. GROWTH OF EMPLOYMENT IN THE INDIAN MANUFACTURING SECTOR, 1950-64

The rate of growth of employment in important sub-sectors of the non-agricultural sector during the period 1951-64 is presented in Table 1. It is clear that Commercial establishments, Posts and Telegraphs and Shops provided employment opportunities at a faster rate than did the manufacturing sector. Apparently, the rapid rate of growth of employment in these sectors is a consequence of the low capital requirement per worker coupled with a rapidly growing demand for their output. Though the growth of employment in the manufacturing sector as a whole was

TABLE 1

RATE OF GROWTH OF EMPLOYMENT IN SELECTED SECTORS, 1951 -1964

	Sector	Rate of Growth (per cent per year) 1951-1961	1961-1964
1.	Commercial Establishments	11.4	7.7
2.	Posts & Telegraphs	6.8	7.1
3.	Shops	6.4	6.4
4.	a) Manufacturing (large) (Census sector)	6.2	7.6
	b) Manufacturing (All)	2.0	5.5
5.	Restaurants & Theatres	4.7	4.9
6.	Railways	2.4	3.2
7.	Mines	2.0	1.6
8.	Plantations	-0.2	-1.5

Sources: 1) Indian Labor Statistics, 1962 & 1969.

2) Report of the National Commission on Labour, 1969.

3) Statistics of Selected Manufacturing Industries, Part I (National Commission on Labour), 1969.

only 2 per cent and 5.5 per cent per year, respectively, during the periods 1951-1961 and 1961-64, the corresponding rates of growth for the large scale manufacturing sector were, however, substantially higher at 6.2 per cent and 7.6 per cent per year. These figures imply that the small scale manufacturing units created employment at somewhat below 2 per cent per year during 1951-61 and 5.5 per cent per year during 1961-64. It is, however, outside the scope of the paper to investigate the poor performance of this sector owing to data constraints already mentioned.

TABLE 2

RATES OF GROWTH OF KEY VARIABLES RELATING TO SELECTED INDUSTRIES, 1950-1964

(per cent)

Variable	All Manu.	Cotton Texts.	Jute Texts.	Sugar	Paper & Paper Boards	Cement	Glass & Glassware
1. Price of output	2.1	2.9	-1.1	3.1	4.2	3.9	?
2. Wage rate:							
a. production worker	4.4	4.7	4.4	8.3	4.9	7.3	5.8
b. non-production worker	5.5	4.6	4.5	6.7	3.7	7.0	6.6
3. Price of key raw material	1.6	0.5	1.4				
4. Cost of fuel, etc.	3.3	3.3	3.3	3.3	3.3	3.3	3.3
5. Price of machinery	4.0	4.0	4.0	4.0	4.0	4.0	4.0
6. Price of construction	3.9	3.9	3.9	3.9	3.9	3.9	3.9
7. General price level	2.3	2.3	2.3	2.3	2.3	2.3	2.3
8. Consumer price index	3.2	3.2	3.2	3.2	3.2	3.2	3.2
9. Price of food articles	2.5	2.5	2.5	2.5	2.5	2.5	2.5
10. Number of registered firms	4.3	1.0	-0.9	2.1	9.6	6.3	1.0
11. Capital stock (current prices)	21.0	10.7	4.6	12.8	20.0	14.0	12.1
12. Employment:							
a. production worker	5.6	1.0	-1.0	-0.2	7.3	4.0	4.8
b. non-production worker	9.2	3.7	0.6	2.1	11.6	7.2	6.2
13. Value added (current prices)	12.6	5.8	3.2	6.6	13.4	9.8	12.5
14. Capital stock (current prices) per production worker	14.9	9.6	5.8	13.0	11.8	9.7	6.9
15. Value added (constant prices) per production worker	4.4	1.9	5.5	3.7	1.4	1.7	?
16. Relative share of labor in value added (average)	56.5	71.3	74.6	44.3	45.8	38.9	73.2

Source: Appendix Tables I through VII.

What are the factors that were responsible for the observed rate of growth of employment in the (large scale) manufacturing sector. 6/ The key variable which have a bearing on the employment situation in the manufacturing sector as well as in certain selected industries are presented in the Appendix Tables I through VII (and the summary in Table 2) for the period 1950-64. 7/ The compound rate of growth of these variables during this period is presented in Table 2. 8/

The value added by the manufacturing sector, measured at current prices, increased at 12.6 per cent per year during this period. At constant prices, it implies a rate of growth of about 10.5 per cent per year. The capital stock (at current prices) increased during this period by 21 per cent while the employment of production and non-production workers rose by 5.6 and 9.2 per cent per year, respectively. If we make allowance for the rise in the prices of capital goods, 8a/ such as machinery and equipment and construction then the capital stock in real terms appears to have grown at an annual rate of 17 per cent. Thus, it is clear that employment in the manufacturing sector did not grow as fast as the value added by this sector and hence the capital stock. In order to determine the future prospects of employment, therefore, it is not only important to understand the factors responsible for the growth of value added but also the process of substituation of capital for labor.

Role of Developmental Policies:

What are the developmental policies that have contributed to the rapid rise in capital per unit of labor during the 1950-64 period? First is, of course, the choice made by the government, as stated in the Second Five Year Plan, in favour of rapid industrialisation with particular emphasis on the development of basic and heavy industries. Given the high capital intensity of these industries, it is obvious why the capital-labor ratio rose as fast as it did. The second important policy is the choice in favor of progressive import substitution which meant a rapid rise

in the domestic production of capital intensive engineering goods among others. While these two policies had a direct impact on the allocation of resources within the manufacturing sector there are other policies which seem to have had an indirect influence on the choice of the capital-labor ratio (by the private sector) in favor of higher capital intensity. The most important among them appears to have been the use of the quantum of capital as the implicit criterion for the rationing of the scarce resources, such as foreign exchange, key raw materials, etc., by the government. 9/ This hypothesis, however, remains to be tested on empirical grounds. In this context, the poor rate of growth of the number of firms 10/ (being only 4.3 per cent per year (Table 2)) is also understandable. The preference in this regard is spelled out clearly in the Third Five Year Plan document: "....expansion of existing plants will have to be given preference over establishment of new units since the creation of additional capacity in this manner will not only be quicker but will also assist in bringing down the investment costs per unit of output". 11/ Imperfections in the capital market, lack of information, etc., could also have contributed to the poor rate of growth of the number of firms.

Changes in Relative Prices:

Now, we turn to the role of relative prices in influencing the choice of factor proportions in the manufacturing process. The role of developmental policies in changing the output - and input -mix within the manufacturing sector discussed above is incomplete insofar as such policies can be potentially used to distort the relative product and factor prices and hence the allocation of resources. Taxes and subsidies are of course the most important instruments in doing so. But other instruments include credit control, direct control on prices of outputs and inputs, discriminatory pricing of transportation of outputs and inputs, distributive control on outputs and inputs, monopoly prices on critical inputs imported by the State Trading Corporation, etc. Most important in the

latter group are the policies relating to the pricing of labor. These policies, in some combination or other, have affected the relative prices faced by different industries at different points in time during the last two decades. It is outside the scope of this paper to assess their combined influence on the structure of relative prices faced by the manufacturing sector.

For the purpose of the present analysis, the structure of the relative prices and the changes in it during the 1950-64 period are taken as given. Thus, we turn our attention now to the problem of substitution among inputs caused by changes in relative prices. The changes in reltive prices have played an important role in determining the level of employment in the manufacturing sector in the past two decades as shown in the analysis that follows. Any attempt to ignore changes in relative prices and concentrate on the aggregate capital-output ratio in projecting the future prospects of employment in this sector is bound to be unrealistic.

The movement of relative prices (during the 1950-64 period) relevant to the present analysis on which data were available is shown in Appendix Tables I through VII and summarised in Table 2. We first note that the wage rate of the production and non-production workers rose faster than did the price of output of the respective industries. Thus, it is clear that the real wage rate facing the manufacturing sector rose at an annual rate between two and three per cent. Secondly, the price of capital goods including machinery and construction rose at an annual rate of four per cent, which implies a rise in the real price of capital goods except in the case of paper and paper boards industry. (To the extent that there has been an improvement in the quality of the capital goods, the rise in the real price of capital goods is overestimated). We also find that in virtually all the cases presented in the Table the wage rate rose faster than the price of capital. 12/

The rise in prices of labor and capital over and above the price of output and hence its effect on pro-

fitability in the manufacturing sector corresponds fairly well with other evidence available in this regard. In particular, reference may be made to the index of the rate of return 13/ on capital in this sector as estimated by the Reserve Bank of India from the finances of the Corporate Sector presented in the Appendix Table VII. The gross rate of return on capital, defined as the share of capital in value added divided by the capital stock, appears to have shown a marked decline from 0.53 in 1946 to 0.13 in 1964. 14/

It is puzzling to note that the wage rate rose faster than the price of capital, given the unemployment situation in the economy and the scarcity of capital. Have the Unions successfully restricted the entry of new labor? Have they successfully influenced the level of the wage rate? Have the developmental policies contributed to the over-pricing of labor and under-pricing of capital? If this is true then it is necessary to identify the specific policies that are responsible because they adversely affect the employment situation. The extent to which the distortion in the relative prices of albor and capital will affect the level of employment depends on the magnitude of the elasticity of substitution between these two inputs underlying the manufacturing process. In Section IV of this paper some empirical investigation regarding the magnitude of the elasticity of substitution is presented with a view to translating the given distortion in relative prices of labor and capital in terms of their relative employments. Finally, if we look at the data for the selected industries presented in Table 2, we find that the capital stock has grown faster in industries where the rate of growth of price of output is higher. Before we conclude this part of the paper, it is useful to note some significant changes in the pattern of employment and income distribution within the labor income generated by the manufacturing sector.

A Digression on the Changes in the Structure of Employment within the Manufacturing Sector:

A striking feature of the growth of employment in the Indian manufacturing sector during the period 1950-64 is that the employment of non-production workers rose at a faster rate than did the employment of production workers. 15/ (See Table 2). Further, the rapid growth in demand for non-production workers or 'skilled' labor (in a relative sense) was followed by a rising share of value added accruing to them. (See Appendix Table I). For the manufacturing sector as a whole, the share of non-production worker wages in value added rose from 10.9 per cent in 1950-51 to 15.1 per cent in 1964-65 while that of production workers showed a declining tendency. Thus, unskilled labor as a group appears to have become worse off during this period despite a significant rise in their real wage rate.

Why did the demand for skilled labor rise faster than that for unskilled? Was it in response to changes in their relative wage rates? In order to answer this question it is useful to divide the period into two, viz., 1950-60 and 1960-64. During the first period, the wage rate of skilled labor rose at 5.5 per cent per year in contrast to 3.5 per cent per year for unskilled labor; yet the demand for skilled labor rose faster at 8.2 per cent per year as compared to 6.1 per cent per year for unskilled. During the second period, 1960-64, the wage rate of unskilled labor rose faster at 7 per cent per year (relative to 4.4 per cent per year for skilled) and in response to these changes, the employment of skilled labor rose at 14.2 per cent per year (as compared to only 6.1 per cent per year for unskilled). From these figures it would appear that the relatively faster rate of growth of employment of skilled labor observed during the period 1950-64 can only be partly explained by the relative movement of wage rates of the two kinds of labor. In order to explain the variations in the relative employments of the two kinds of labor fully, one must look at the substitution possibolities between the two types of labor and other inputs in the

production process. The evidence presented in sections III and IV of the paper would appear to suggest that there exists a considerable degree of complementarity between skilled labor and capital. For the present, however, it may be noted from Table 2 that the rate of growth of employment of non-production workers was generally higher, the higher the rate of growth of capital stock. 16/

If we look at the selected industries (Appendix Tables I thru VII) we find that the picture broadly follows the pattern of the manufacturing sector as a whole with the following significant exceptions. The share of production and non-production workers' wages in value added in the sugar industry showed a rise instead of a fall inspite of the fact that the industry faced a rapid rise in the wage rate. This would seem to indicate that the elasticity of substitution of capital and labor is somewhat below unity. Growth of employment in the cement and paper industry would appear to have been limited by the rise in the wage rate, particularly if we look at the movement of wage rate and employment during the two periods (1950-60 and 1960-64) separately, with the latter period showing a faster rise in wage rate.

To summarise this digression, the non-production workers (or the skilled labor) appear to have experienced a faster rate of growth of demand for their services as well as a relatively larger share of the value added by manufacturing. The main reasons for the redistribution of income in their favour seem to be: i) a relatively faster rise in the unskilled wage rate; ii) complementarity between capital stock and skilled labor; and iii) a rapid growth of capital stock relative to labor during the 1950-64 period.

III. THE STRUCTURE OF THE INDIAN MANUFACTURING SECTOR*

The relationship between employment, on the one hand,

* I would like to thank Mr. S.M. Luthra for the computer assistance in obtaining the results presented in Section III and IV of the paper.

and value added and capital stock, on the other, is further explored in this part of the paper using the Annual Survey of Industries (Census Sector) data across industries for the years 1960 through 1964. A second aspect of the inquiry relates to the question of complementarity between skilled labor and capital stock raised in the last section of the paper. With these ends in view, the input and output mix in the manufacturing sector are analysed below. Much of the recent growth in the manufacturing sector being attributable to the emergence of a new non-traditional sector, it is particularly important to understand the consequences of this transformation on employment.

A word about the definition of the variables used in the study. Value added is defined as gross of depreciation to avoid any arbitrariness in the measurement of the latter. Capital stock refers to the book value as on the last date of the reference year in most of the cases. For the purpose of the present analysis two variants of capital were defined. The first refers to the fixed capital employed (K1) and is so referred where it occurs. The second, widely used in this paper, refers to the sum of fixed capital and one-half of the working capital (K2) and is referred to as capital. The gross rate of return on capital is simply measured as a ratio of (gross) value added less total payroll to the capital employed. The definition of production and non-production workers remains the same as before. 17/

The distribution of value added (VA), fixed capital (K1), capital (K2), employment (N) and production workers (PW) by the capital-intensity (K2/N) of industries 18/ for the year 1960 is presented in Table 3. We first note that over 90 per cent of all the labor employed in the manufacturing sector was in industries where capital requirement per worker was below Rs.11,600; they worked with 65 per cent of all capital employed in this sector and produced 79 per cent of the total value added by this sector. The picture remains broadly the same even if we measure capital-intensity as capital per production worker.

If we define capital intensity in terms of the

relative share of capital (vis-a-vis labor) in value added then we find the following (Table 4) distribution of the key variables.

TABLES 3

DISTRIBUTION OF KEY VARIABLES BY CAPITAL INTENSITY
1960

In the Indian Manufacturing Sector

(Percentages)

Capital per unit of labor (Rs.) (1)	VA (2)	K1 (3)	K2 (4)	N (5)	PW (6)
165 - 5884	54	36	38	73	76
5884 - 11603	25	25	27	18	16
11603 - 17322	7	7	8	3	3
17322 - 23041	9	23.	19	5	4
23041 +	5	9	8	1	1
TOTAL	100	100	100	100	100

Tables 3 and 4 show that considerable variations in factor proportions exists within the manufacturing sector. If we compare columns 5 and 6 in Table 3 we find that less capital intensive industries employ a relatively larger proportion of production workers. This relationship is made explicit in Table 5 below for the year 1964.

Table 5 shows clearly that the number of production workers relative to the number of non-production workers tends to fall as rapidly as the capital intensity of the

TABLE 4

DISTRIBUTION OF KEY VARIABLES BY RELATIVE SHARE OF LABOR
1960

In the Indian Manufacturing Sector

(Percentages)

Relative share of labor in value added (1)	VA (2)	K1 (3)	K2 (4)	N (5)	PW (6)
0.07 - 0.23	8.7	8.2	9.0	2.0	2.0
0.23 - 0.50	39.0	52.7	51.4	26.0	24.4
0.50 - 0.65	38.5	27.6	27.4	46.2	47.2
0.65 - 0.81	11.2	9.4	9.5	20.6	21.2
0.81 +	2.6	2.1	2.7	5.2	5.2
TOTAL	100.0	100.0	100.0	100.0	100.0

industry increases. Thus, the hypothesis that capital and skilled labor are complementary, postulated on the basis of the time series data in Section III, seems to hold for the cross section data as well. Incidentally, if we compare the distribution of K1 and K2 we note that less capital intensive firms tend to hold a relatively larger proportion of inventories because the difference between K1 and K2 reflects the value of inventories.

We also notice from Table 5 that 50 per cent of all the capital in this sector is located in less capital intensive industries (where capital per worker is below Rs.15,713), and that these industries offered employment

TABLE 5

DISTRIBUTION OF CAPITAL AND LABOR BY CAPITAL INTENSITY (K2/N) 1964

In the Manufacturing Sector

(Percentages)

Capital Employed per unit of labor (Rs.)	K1	K2	N	PW	PW/NPW
270 - 7991	26.1	29.0	68.5	71.0	8.836
7991 - 15713	21.0	21.7	18.7	17.5	4.262
15713 - 54320	48.0	44.3	12.2	11.0	3.582
54320 - 62042	1.4	1.2	0.2	0.2	3.194
62042 +	3.5	3.8	0.4	0.3	3.156
TOTAL	100.0	100.0	100.0	100.0	

to nearly 90 per cent of all the labor in this sector. It is interesting to know which are the other industries employing relatively so little labor and yet possessing 50 per cent of all the capital in this sector. The list of industries in this category is presented in the Appendix. It is obvious from this list that virtually all these industries came into existence in recent years and mainly in response to our import substitution policy. It would appear, therefore, that the reduction in our balance of payments deficit, achieved as a result of this policy, was accomplished at the cost of a slower increase in employment than would be the case in the absence of the policy of import substitution. Whether this policy is optimal or not must, however, be evaluated in relation to alternative development strategies.

From the above discussion it follows that much of the rise in the capital labor ratio is the result of our conscious policy to change the output mix of the manufacturing sector in favor of capital intensive goods. It is important to recognize this fact because some of the empirical studies* attempting to measure the elasticity of substitution between capital and labor have treated the variations in the capital-labor ratio as solely a response to variations in their relative prices while in fact some of the variations were caused by the developmental policies operating outside the realm of relative prices. 19/

What emerges from the discussion in this section of the paper is the following. Developmental policies have played an important role in altering the industrial structure of the economy. The changes in the structure in turn have a significant effect on aggregate employment in manufacturing. Further, changes in the structure tend to produce differential effects on the demand for skilled and unskilled categories of labor in this sector.

IV. ECONOMETRIC INVESTIGATION OF EMPLOYMENT IN MANUFACTURING

The empirical evidence presented thus far suggests that determinants of employment in the Indian manufacturing sector in recent years include not only the relative product and factor prices but also the exogenous policy variables, insofar as the latter have an independent effect on employment. If the policy variables have mainly influenced the product mix, as appears to be the case, then their combined effect on employment can be assessed by estimating the demand function for labor separately for such sub-groups of the manufacturing sector which were subject to the policy influences. This approach is also necessary if, in fact, the production process underlying the different sub-groups

* See, for example, Banerji, Asit, "Capital Intensity and Economic Efficiency in Indian Industry", op.cit.

is different. An attempt is this section to fit the model described below separately for the two sub-sectors of the Indian manufacturing sector, with a view to assessing the differences in the magnitude of response of employment to output and prices which are attributable to the development policies.

The Model:

Let $Y = f(L_1, L_2, K)$ (1)

represent the production function, where Y is value added, L_1 is unskilled labor, L_2 is skilled labor and K is the capital stock. Let us assume that the production function is homogenous of the first degree with respect to the inputs.20/ Assuming that the relative product and factor prices are given, 21/ then profit maximisation by firms subject to be production function constraint yields the demand function for L_1, L_2 and K in terms of the product and factor prices.

This procedure assumes that the firms can adjust the relative employment of the inputs instantaneously in response to a given change in relative prices or other signals. It is argued elsewhere 22/ that this assumption is unrealistic because the facility with which the different inputs can be varied depends on the length of the time period. Accordingly, the following assumptions are made in the model below. It is assumed that production workers (L_1) can be varied relatively easily, relative to L_2 and K. Again, L_2 can be varied relatively easily, relative to K. Finally, K can be varied only in the long run.

Given these assumptions, derivation of demand functions for the three inpus follows a recursive system of equations. In the shortest run, the demand function for L, looks as follows:

$$L_1 = L_1 \ (P_Y \ , \ P_{L_1} \ / L_2 = L_2^0 \ , \ K = K^0 \ ) \qquad (2)$$

where L_2^0 and K^0 represent the current levels of these inputs

(which are fixed by assumption). When sufficient time is allowed for L_2 to vary also, then the demand function for L_2 is as follows:

$$L_2 = L_2 \ (P_Y \ , \ P_{L_1} \ , \ P_{L_2} \ /K = K^0 \ ) \qquad (3)$$

Finally, in the long run when all inputs are variable, the demand function for K is as shown below.

$$K \ = \ K \ (P_Y \ , \ P_{L_1} \ , \ P_{L_2} \ , \ P_K \ ) \qquad (4)$$

From (2), (3) and (4) we can derive the long run parameters23/ in the demand functions for L_1 and L_2 given below.

$$\left.\begin{aligned} L_1 \ &= \ g(P_Y \ , \ P_{L_1} \ , \ P_{L_2} \ , \ P_K \ ) \\ L_2 \ &= \ h(P_Y \ , \ P_{L_1} \ , \ P_{L_2} \ , \ P_K \ ) \end{aligned}\right\} \qquad (5)$$

The estimation of long run parameters is important because they reflect the ultimate effect of the changes in the independent variables on the employment of L_1 and L_2.

The model described above needs some modifications because the presence of developmental policies may affect the demand for labor through changes in input mix, independently of the changes in relative prices. 24/ For the purpose of the present analysis, it is assumed that all developmental policies essentially influence the level of capital stock (K) as determined by the firm and that K in turn transmits the influence on to L_2 and L_1 respectively. Thus equation (4) above must also include policy variables on the right hand side of the equation. No attempt, however, is made in this paper to estimate (4) owing to the absence of relevant data, and hence the determination of K is left open to question.

In order to estimate (2) and (3) we need data on P_{L_1} , P_{L_2} and P_Y as well. The Annual Survey of Industries does not provide any data on the average price received per unit of output for different industries. One possibility, therefore, is to delete the variable P_Y from the demand relationships and assess the consequences on the estimated coefficients of the included variables in terms of a 'left-out variable regression model'. 25/ The second possibility is to estimate the following alternative versions of (2) and (3):

$$L_1 = l_1 \, (Y / L_2^{o} \, , \, K = K^{o} \,) \qquad (6)$$

$$L_2 = l_2 \, (Y / K = K^{o} \,) \qquad (7)$$

The rationale for this substitution stems from the assumption that Y reflects the equilibrium level of output (Y) resulting from changes in P_Y , P_{L_2} and P_{L_2}. 26/

The demand relationships postulated above assume that the desired level of L_1 (and L_2 and K) in the new relative price situation equals the actual level observed. Insofar as there exists a discrepancy between the desired and actual levels of an input it is necessary to introduce an adjustment mechanism by which the two will approach equality, when sufficient time is allowed. The simplest adjustment model is the Koyck type described below:

$$\left.\begin{aligned} L_1^{*} &= \phi \left[P_{Y_1} \, , \, P_{L_1} / L_2 = L_2^{0} \, , \, K = K^{0} \right] \\ \text{and} \quad (L_1 - L_{1_{-1}}) &= (L_1^{*} - L_{1_{-1}}) \end{aligned}\right\} \qquad (8)$$

Where L is the desired level of employment of L_1, and $L_{1_{-1}}$ is the lagged value of L_1 , lagged by one year.

Similar adjustment mechanisms can be introduced in (3) above as well.

The demand relationships postulated above tell us how each one of the factors of production responds to changes in relative prices in the short and in the long run. It is equally interesting to know how the relative factor proportions will change in response to a given change in the relative prices. The elasticity of substitution parameter, which reflects this response, can be estimated through two alternative approaches. The first is to relate the ratio of factor quantities directly to the ratio of the factor prices. Obviously, this procedure assumes that there are only two variable factors of production present in the production functions. The second approach is to relate the value added per worker with the wage rate, both variables measured in logarithms.27/

To estimate the elasticity of substitution between capital and labor through the first approach we need data on the price of capital as well. The latter can be estimated as the gross rate of return on capital (GRR2) defined as the ratio of gross profits to capital employed. It is not clear how good GRR2 is as a measure of alternative cost of capital services. Therefore, greater stress is laid on the second approach in estimating the elasticity parameter in this paper. Further, this approach makes it possible to estimate the elasticity of substitution between L_1 , L_2 and K (taken individually) with the corresponding two excluded factors as a whole. But the main weakness of this approach is that it assumes the presence of long run equilibrium, among others. In order to recognise the existence of incomplete adjustments in factor employments it is necessary to evaluate this relationship when the other factors are held constant at their respective current levels. Thus, the estimated elasticity of substitution reflects the short run situation when some factors are not variable. Further, insofar as adjustment in variable factors is incomplete even within the short run, an adjustment mechanism analogous to that specified above for the demand function is called for. Thus the model relevant to the estimation of the elasticity of substitution, for example, between L_1 and the

other two factors (L_2 and K) looks as follows:

$$\left.\begin{aligned} &\left(\log \frac{Y}{L_1}\right) = a_o + a_1 \log P_{L_1} + a_2 \log \frac{K}{L_1} + a_3 \log \frac{L_2}{L_1} \\ \text{and} \quad &\left[\log \frac{Y}{L_1} - \left(\log \frac{Y}{L_1}\right)_{-1}\right] = \gamma\left[\left(\log \frac{Y}{L_1}\right)^* - \left(\log \frac{Y}{L}\right)_{-1}\right] \end{aligned}\right\} \quad (9)$$

where a represents the short run elasticity of substitution and $(\log \frac{Y}{L_1})^*$ represents the desired level of $(\log \frac{Y}{L_1})$.

Empirical Results:

Before we comment on the results, a brief review of the estimates of the relevant parameters obtained by other researchers is presented below. First we note that much of the empirical analysis on the manufacturing sector in the past was related to the estimation of the production function with or without restrictions on returns to scale. Another aspect of such an analysis relates to the estimation of the elasticity of substitution parameters. These investigations, in many cases, were based on the Census of Manufactures data prior to 1958, though some of the recent studies have utilized the ASI data upto 1964. The analyses generally concentrated on variations over time and/or regions within specific industries and the manufacturing sector as a whole.

These studies 28/ found that constant returns to scale generally prevail in the manufacturing sector. Sankar, 29/ using the cross sectional data across regions for the years, 1953-58, found that the scale parameter was significantly above unity for few industries. Further, the key parameters appear to vary somewhat with the size of the firm. If in fact such economies of scale exist then it follows that demand for labor increases, but less than proportionately, with output. More important than the scale parameter, however, is the elasticity of substitution of capital and labor. Given the assumption of constant returns to scale,

these studies indicate that the elasticity of substitution is around unity for the manufacturing sector as a whole and somewhat below one for some industries.

Demand for Production and Non-production Workers:

The empirical results obtained in this study are presented in Tables 6 and 7 and summarised in Table 8. A comparison of the two tables or the results for the two sub-sectors of manufacturing in Table 8 clearly shows that the estimated parameters are significantly different from each other for the two sets of data.

First we note that the demand relations for production workers measured in man hours rather than in numbers appear to describe the data better. The coefficient of adjustment in these relations (equal to one minus the coefficient of the lagged dependent variable) for the less capital intensive (or the traditional) sector is about one half of the corresponding coefficient for the capital intensive (or modern) sector. In other words, during the period 1960-64, the capital intensive sector showed a relatively greater urge to change the employment levels of production workers toward the desired levels. This is in conformity with the earlier observation based on time series data that much of the recent growth in employment was due to change in product mix and the rapid emergence of a new non-traditional sector.

The results summarised in Table 8 indicate the effect of wage rates, value added and capital stock on the employment of production and non-production workers for the two subsectors of manufacturing.30/ The figures given here represent the ultimate effect of the independent variable on the concerned dependent variable when all adjustments are complete. Insofar as the wage rate has a significant effect on the capital stock variable, which in turn affects the level of employment, the elasticities of demand with respect to the wage rate in the Table do not reflect the true long run situation.

A 10 per cent rise in the production workers' wage rate appears to result in a greater decrease in the demand

TABLE 6

DEMAND FOR PRODUCTION AND NON-PRODUCTION WORKERS IN INDIAN MANUFACTURING (LESS CAPITAL INTENSIVE SECTOR), 1960-64*

Number of observations : 640

Variable \ Eqn.No.	2.1.1	2.1.2	2.1.3	2.1.4	2.1.5	2.1.6	2.1.7	2.1.8	2.1.9	2.1.10	2.2.1	2.2.2	2.2.3
Dependent Variable	PW	PW	PW	PWMH	PWMH	PWMH	PW	PW	PWMH	PWMH	NPW	NPW	NPW
R^2	0.926	0.926	0.925	0.923	0.922	0.921	0.924	0.679	0.921	0.697	0.884	0.886	0.777
Independent Variables													
Constant	-0.352	-0.416	-0.737	1.379	1.246	0.660	0.341	2.852	1.078	8.355	-2.937	-2.156	-5.186
	(0.172)	(0.161)	(0.114)	(0.240)	(0.224)	(0.145)	(0.189)	(0.372)	(0.262)	(0.388)	(0.236)	(0.257)	(0.316)
VA	0.103	0.088	0.115	0.127	0.104	0.142					0.136		
	(0.021)	(0.016)	(0.021)	(0.023)	(0.018)	(0.023)					(0.030)		
NPW	0.062	0.053		0.082	0.068		0.085	0.557	0.105	0.562			
	(0.021)	(0.019)		(0.022)	(0.020)		(0.021)	(0.037)	(0.022)	(0.037)			
K2	-0.020		0.002	-0.031		-0.002	0.062	0.179	0.069	0.194	0.173	0.304	0.727
	(0.019)		(0.017)	(0.020)		(0.018)	(0.016)	(0.033)	(0.017)	(0.033)	(0.027)	(0.023)	(0.022)
WP							-0.087	-0.260				0.188	0.409
							(0.028)	(0.057)				(0.051)	(0.070)
WNP												-0.257	-0.564
												(0.044)	(0.058)
WPMH									-0.127	-0.238			
									(0.032)	(0.062)			
PW_{-1}	0.810	0.813	0.833				0.838						
	(0.019)	(0.019)	(0.018)				(0.018)						
$PWMH_{-1}$				0.772	0.777	0.801			0.811				
				(0.020)	(0.020)	(0.019)			(0.019)				
NPW_{-1}											0.602	0.603	
											(0.025)	(0.024)	

* All variables measured in logarithms; inlustries included here are listed in the Appendix.

Note: Figures in brackets represent standard error of the corresponding estimated coefficient.
Variable names with subscript '-1' denote the corresponding values lagged by one year.

PWMH - Production worker manhours per firm
PW - Production workers per firm
NPW - Non-production workers per firm
VA - Value added per firm
K2 - Capital per firm
WP - Production worker wage rate
WNP - Non-production worker wage rate
WPMH - Wage rate per production worker manhours
GRR2 - Ratio of gross profits to K2
W - Average wage rate for all workers
N - PW + NPW

TABLE 7

DEMAND FOR PRODUCTION AND NON-PRODUCTION WORKERS IN INDIAN MANUFACTURING (CAPITAL INTENSIVE SECTOR), 1960-64*

Number of observations : 99

Variable \ Eqn.No.	3.1.1	3.1.2	3.1.3	3.1.4	3.1.5	3.1.6	3.1.7	3.1.8	3.1.9	3.1.10	3.2.1	3.2.2	3.2.3
Dependent Variable	PW	PW	PW	PWMH	PWMH	PWMH	PW	PW	PWMH	PWMH	NPW	NPW	NPW
R^2	0.923	0.922	0.918	0.925	0.924	0.919	0.926	0.804	0.927	0.822	0.843	0.886	0.741
Independent Variables													
Constant	-0.329	-0.176	-0.653	2.489	2.624	1.389	0.314	0.374	2.300	6.021	-1.130	-0.107	-2.174
	(0.402)	(0.386)	(0.394)	(0.525)	(0.521)	(0.382)	(0.411)	(0.665)	(0.535)	(0.664)	(0.654)	(0.618)	(0.882)
VA	0.060	0.105	0.048	0.080	0.134	0.069					-0.074		
	(0.049)	(0.035)	(0.050)	(0.050)	(0.036)	(0.052)					(0.078)		
NPW	0.125	0.144		0.147	0.168		0.135	0.495	0.156	0.518			
	(0.048)	(0.046)		(0.050)	(0.048)		(0.047)	(0.060)	(0.050)	(0.060)			
K2	0.058		0.093	0.070		0.108	0.129	0.309	0.153	0.327	0.232	0.226	0.503
	(0.044)		(0.044)	(0.046)		(0.046)	(0.035)	(0.051)	(0.036)	(0.050)	(0.070)	(0.043)	(0.051)
WP							-0.120	-0.228				0.349	0.737
							(0.056)	(0.089)				(0.103)	(0.145)
WNP												-0.488	-0.853
												(0.081)	(0.111)
WPMH									-0.121	-0.249			
									(0.057)	(0.087)			
PW_{-1}	0.635	0.640	0.721				0.638						
	(0.054)	(0.054)	(0.044)				(0.051)						
$PWMH_{-1}$				0.595	0.602	0.689			0.595				
				(0.052)	(0.053)	(0.043)			(0.051)				
NPW_{-1}											0.654	0.527	
											(0.052)	(0.048)	

* All variables measured in logarithms; industries included here are listed in the Appendix.

Note: Figures in brackets represent standard error of the corresponding estimated coefficient.
Variable names with subscript '-1' denote the corresponding values lagged by one year.

PWMH - Production worker manhours per firm
PW - Production workers per firm
NPW - Non-production workers per firm
VA - Value added per firm
K2 - Capital per firm
WP - Production worker wage rate
WNP - Non-production worker wage rate
WPMH - Wage rate per production worker manhours
GRR2 - Ratio of gross profits to K2
W - Average wage rate for all workers
N - PW + NPW

TABLE 8

SUMMARY OF EMPIRICAL RESULTS
DEMAND FUNCTIONS

	Less capital intensive sector (No. of observations 640)	Capital intensive sector (No. of observations 99)
Production Workers:		
Elasticity of demand with respect to:		
1. a) Production worker wage rate	-0.66	-0.30
b) Non-production worker wage rate	-0.35	-0.40
c) Capital stock	+0.82	+0.57
2. a) Value added	+0.56	+0.30
b) Capital stock	+0.13	+0.42
Non-production Workers:		
Elasticity of demand with respect to:		
1. a) Production worker wage rate	+0.47	+0.72
b) Non-production worker wage rate	-0.64	-1.03
c) Capital stock	+0.76	+0.48
2. a) Value added	+0.34	N.S.
b) Capital stock	+0.43	+0.66

Note: N.S. - Not significant.

for production workers in the less capital intensive sector than in the capital intensive sector. This observation is consistent with the estimates of elasticity of substitution between capital and labor for the two sectors separately, given later in the paper. The effect of a rise in the non-production workers' wage rate on the demand for production workers is negative when capital stock is held constant. The result thus suggests at least a weak complementarity between the two types of labor. The effect of an increase in capital stock on employment of production workers is positive and higher in the less capital intensive sector, as expected, compared to the other sector. If we use value added as an explanatory variable instead of wage rates then again we find that a 10 per cent increase in value added is followed by a 5.6 per cent rise in production worker employment in the less capital intensive sector compared to only 3 per cent in the other sector. An increase in value added will, of course, have a larger effect via the capital stock on production worker employment in both the sectors in the long run when capital stock also shows a positive response to a rise in value added.

The demand for non-production workers appears to be more elastic with respect to own wage rate in the capital intensive sector in comparison with the other sector. A rise in capital stock leads to a relatively larger percentage increase in the demand for non-production workers in the less capital intensive sector.

To summarise the results presented thus far, we find that the demand for production workers is relatively more elastic in the less capital intensive sector. Further, the shifts in this function caused by a changes in the non-production worker wage rate and in the capital stock are larger relative to the shifts produced in the capital intensive sector. Policies designed to increase employment through increases in value added and in capital stock and changes in relative wage rates will be more effective when they operate on the less capital intensive sector.

What is the consequence of leaving out the price of

the output variable in regard to the results presented above? Under plausible assumptions, the effect of leaving out the price of the output variable from the regressions (in the demand function for production workers) is to underestimate the absolute value of the true coefficients of wage rates; and overestimate the true coefficients of capital stock and value added. Similar consequences follow for the demand functions for non-production workers, except that the cross elasticity of demand with respect to production worker wage rate is overestimated because it has a positive sign in the estimated equations. 31/ Thus the direction of bias on the estimated coefficients for the two sectors separately is the same, and hence, the relative positions of the coefficients for the two sets of data, on which the summary of results presented above is based, are unlikely to change.

What is the effect of neglecting the capacity utilization variable in the above analysis? If the extent of under-utilization of capacity is the same for all industries then it will not bias the elasticity coefficients estimated above. But we do know that capacity under-utilization tends to increase with increase in the capital stock. Thus, under plausible assumptions, one should expect that the effect of an increase in the capital stock on the demand for the two types of labor is underestimated in the above regressions.

Elasticity of Substitution between Production Workers, Non-production Workers and Capital:

The elasticity of substitution parameter tells us directly the consequence of a change in, say, the price of labor relative to the price of capital on the relative proportions of labor and capital employed as well as what happens to the relative shares of labor and capital in value added. When this parameter exceeds unity then a relative rise in the wage rate leads to a decrease in the relative share of labor in value added. If, however, the parameter is less than one then a rise in the relative wage rate increases the relative share of labor in value added.

Estimates of the elasticity of substitution parameter are presented in Table 9. Equation 2.5.1 gives us

an estimate of the elasticity of substitution between (all) labor and capital. We note that it is somewhat over unity for the less capital intensive sector and under unity for the capital intensive sector, as expected. The difference actually reflects the nature of the technology prevailing in the two sectors. Thus, a policy to lower the relative price of labor relative to the price of capital (vis-a-vis rise the price of capital relative to that of labor) as a corrective measure to counteract the imperfections in the labor and capital markets will have a more favourable effect on employment in the less capital intensive sector than in the other sector. An alternative estimate of this parameter is presented in equation 2.5.2. Clearly these estimates are much smaller than the corresponding estimates from 2.5.1., as was found in many other studies in this area.

Before we conclude this section of the paper it is interesting to look at the estimates of the elasticity of substitution parameters between production workers, on the one hand, and non-production workers and capital, on the other. From equation 2.6.2 it is clear that the elasticity of substitution shows a wider divergence (1.08 and 0.64) between the two subsectors of manufacturing. Holding other variables (such as K2/PW and NPW/PW) constant does not reduce this divergence. Similarly, the elasticity of substitution between non-production workers, on the one hand, and production workers and capital, on the other, is estimated in equation 2.7.1. It is striking that the elasticity is larger (0.95) for the capital intensive sector as compared to (0.69) the other sector. But this difference is considerably reduced when capital stock per non-production worker is held constant.

In conclusion it may be stated that the possibilities for increasing the level of employment in the manufacturing sector through policy measures designed to influence the choice of factor proportions are not the same in the two sub-sectors. Policy measures appear to have a greater leverage in employment creation when directed toward the less capital intensive sector.

V. POLICY IMPLICATIONS AND CONCLUSIONS

What are the prospects for increasing employment in Indian manufacturing, say, over the next decade? In this part of the paper the prospects for increasing employment are discussed first in the context of the Plan objectives and past developmental policies. We then proceed to discuss the alternative policy measures with a view to increasing the prospects for a faster growth of employment.

The Fourth Five Year Plan envisages a rate of growth of net output from mining, manufacturing and construction of about 9 per cent per year over the next decade. 32/ If large scale manufacturing shows a faster rate of growth, say, 50 per cent faster than was observed in the past, then the output in this sector can be expected to grow at a little over 13 per cent per year, which is higher than the rate of growth of value added of 10.5 per cent per year observed during 1950-64 period. Assuming that the rate of growth of output in this sector envisaged in the Plan will be realized, what is its implication for additional employment?

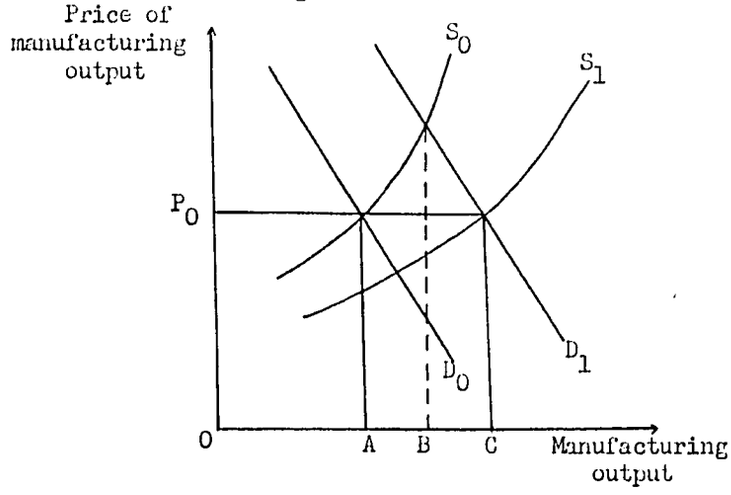
Given constant returns to scale and assuming no change in relative prices as well as the absence of developmental policies and technological change, a 13 per cent annual rate of growth in value added would imply that both labor and capital would also grow at the same rate. In the presence of developmental policies designed to change the industrial structure in favour of capital intensive industries, the rate of growth of labor will be obviously smaller than the envisaged 13 per cent annual rate of growth in value added. If, for example, the developmental policies in favor of capital intensive industries are pursued as vigourously as in the recent past then employment will grow only half as fast - about $6\frac{1}{2}$ per cent per year as observed in 1950-64 period - as otherwise.

What are the policy measures which will raise the rate of growth of employment in this sector, subject to the constraint that the rate of growth of capital is the

same as implied by the Fourth Plan document? Apparently the policy measures must be such as to reduce the average capital-labor ratio in this sector. It is possible to do so through a change in the product mix in favour of less capital intensive products if there is a constraint on the choice of factor proportions. Alternatively, it is possible to accomplish a reduction in the capital-labor ratio through a choice in favor of relatively labor intensive techniques where such choices are feasible. In addition to the above policy measures, designed to bring about a reduction in the capital requirement per unit of labor, there are other policies, discussed below, which will promote the growth of output in the manufacturing sector.

Raising the rate of growth of output in manufacturing:

The evidence presented in section II regarding the movement of relative prices suggests that input prices generally rose faster than output prices. We also know that there are severe constraints on the supply side, such as raw material shortages (imported and domestic), which have crippled the growth of the manufacturing sector through steeply rising costs of production as well as the under-utilization of existing capacity. 33/ The Planning Commission is painfully aware of the cost of these constraints - "... if there are undue delays in bringing capacity to full utilization, the cost in terms of the capital locked up and possible sacrifice of alternative opportunities for using this capital could be very large". 34/ The situation is illustrated in the diagram below.



The diagram makes it clear that a given shift in the demand function for manufacturing products (from D_0 to D_1) caused by, say, income and population growth, is followed by less than proportionate increase in the supply of manufacturing output if the present supply situation is represented by the curve S_0. Any relaxation of the supply constraints will lead to a more elastic supply situation such as a curve S_1. Thus, the given shift in the demand for manufacturing is fully matched by an increase in supply of the same amount, leaving the price unchanged at P_0.

In order to bring about a shift in the supply curve such as the one described above, it is necessary to allocate the capital and other resources with a view to eliminating the critical shortages that cripple the growth of this sector. The main instruments to accomplish this objective would appear to be the industrial licensing procedure and the system of price control. In particular, it is important to recognize the consequences of controlling the prices of such critical raw materials for the prices of (other) manufactured products. This policy would also help the export of manufactured products in so far as such raw material have crippled their growth in the past. As a corollary to this policy, it follows that a flexible foreign exchange policy, specifically designed to encourage exports and discourage imports, would go a long way in boosting the rate of growth of manufacturing output; as this policy would lead to greater demand for exportable capital intensive products and utilization of capacity in these industries and thus augment the available foreign exchange resources which, in turn, can be used to ease the supply constraints arising out of a shortage of foreign exchange.

Reducing the Capital Intensity in Manufacturing:

A policy designed to reduce capital intensity may seem contradictory on the ground that it runs counter to the objective of raising labor productivity through capital deepening. The pertinent question in this context is to ask: what are the economic and social implications of such a policy when there is widespread unemployment and under-

employment in the economy? If we take input prices as reflecting the real scarcities, simple economic theory would suggest that we ought to maximize output per unit of capital by employing as much labor as is possible with the given quantity of capital. Under these circumstances the optimal policy would appear to be one of capital "shallowing" rather than deepening. Further, capital "shallowing" would lead to a greater equality in the distribution of income than otherwise possible. The general criticism against this approach is that it will lower the rate of growth of capital goods output and hence increase the dependence on the rest of the world. Is this criticism still valid when we have excess capacity (and lack of demand) in the capital goods industries? In any event the choice between the two alternative policies boils down to choosing between unemployment and a scarcity of foreign exchange. 35/ Insofar as there are other instruments to tackle the foreign exchange situation it would appear that a policy of capital widening is desirable, particularly because a substantial capacity in capital goods industries has already been created.

A choice in favor of the less capital intensive industries in order to raise the rate of growth of employment is desirable for several reasons, provided that a transfer of capital resources to this group of industries can also be justified on the social rate of return criterion.

The response of employment to a given change in value added or other inputs or relative prices is more favourable for the less capital intensive sector relative to the capital intensive sector. Further, the elasticity of substitution between capital and labor is relatively larger for the less capital intensive sector. Thus, any policy measure designed to alter the demand for labor will have a greater leverage if directed to the less capital intensive sector. In this context, the present emphasis on the growth of small industries is well placed.

Other general policy measures which would promote the growth of employment in this sector include the elimination of imperfections in the market for job information, incentives to corporations to induce investment in labor

where returns on such investment do not accrue to the firms, provision of such skills and training for labor that are demanded by industries, extension and consultancy services for small industries, etc. Such policy measures, designed to improve the quality of the labor force, assume greater importance in the long run when the bulk of the addition to labor force is expected to come from the rural sector.

VI. SUMMARY

Between 1950 and 1964 employment in the large scale manufacturing sector increased at an annual rate of about 6 per cent, or a little more, while the real value added by this sector rose at an annual rate of over 10 per cent. During the same period capital stock, at constant prices, rose at an annual rate of about 17 per cent per year. Thus, the growth of employment lagged behind the growth of value added and capital stock.

An attempt is made in this paper to identify the force that were responsible for the observed growth rate in employment with a view to using the knowledge thus gained for the purpose of determining the future employment prospects in this sector. In particular, attention is focussed on the question: why did the capital-labor ratio show a rapid rise inspite of the relative abundance of labor and scarcity of capital in the economy? Two major forces are identified as being responsible for this rise in the capital-labor ratio. The first relates to the developmental policies, such as the bias in favor of basic and heavy industries and the import substitution policy among others. The second is, of course, the changes in relative prices.

It is shown that developmental policies produced a substantial change in the industrial structure of the economy. The change was transmitted to the factor proportions through the product mix. Given the technique of production, the change in the product mix was such as to increase the capital intensity (vis-a-vis reduce the labor per unit of capital). Implicit in the formulation of the developmental policies was of course the assumption

TABLE 9

ESTIMATES OF ELASTICITY OF SUBSTITUTION

Variable \ Eqn.No.	2.4.1.	2.4.2	2.5.1	2.5.2	2.6.1	2.6.2	2.6.3	2.6.4	2.6.5	2.7.1	2.7.2
Dependent Variable	NPW/PW	NPW/PW	VA/N	K2/N	VA/PWMH	VA/PW	VA/PWMH	VA/PW	VA/PWMH	VA/NPW	VA/NPW
				Less Capital Intensive Industries ; No. of observations 640							
R^2	0.248	0.077	0.640	0.269	0.497	0.556	0.695	0.730	0.701	0.360	0.492
Constant	-4.238	-1.579	0.360	4.426	1.114	0.491	0.542	0.212	1.661	4.719	2.765
	(0.229)	(0.066)	(0.232)	(0.260)	(0.028)	(0.277)	(0.035)	(0.216)	(0.318)	(0.296)	(0.305)
K2	0.193										
	(0.016)										
WPMH(or WP for 2.6.2&2.6.4)	0.461a/	0.482a/	1.054b/	0.472c/	1.065	1.082	0.604	0.623	0.607		
	(0.060)	(0.066)	(0.031)	(0.031)	(0.042)	(0.038)	(0.040)	(0.037)	(0.040)		
K2/PWMH(or K2/PW for 2.6.4)							0.422	0.421	0.373		
							(0.021)	(0.021)	(0.025)		
NPW/PWMH									0.110		
									(0.031)		
WNP										0.688	0.408
										(0.036)	(0.039)
K2/NPW											0.401
											(0.031)
				Capital Intensive Industries ; No. of observations 99							
R^2	0.334	0.327	0.355	0.287	0.259	0.209	0.455	0.472	0.465	0.473	0.664
Constant	-0.336	-0.919	3.170	6.502	1.703	4.554	0.490	2.495	-0.754	2.746	-0.022
	(0.605)	(0.085)	(0.825)	(0.584)	(0.050)	(0.803)	(0.211)	(0.770)	(0.970)	(0.870)	(0.792)
K2	-0.035										
	(0.036)										
WPMH(or WP for 2.6.2&2.6.4)	0.609a/	0.580a/	0.762b/	0.393c/	0.633	0.635	0.304	0.285	0.327		
	(0.090)	(0.084)	(0.104)	(0.063)	(0.108)	(0.105)	(0.109)	(0.107)	(0.110)		
K2/PWMH(or K2/PW for 2.6.4)							0.455	0.457	0.462		
							(0.077)	(0.076)	(0.072)		
NPW/PWMH									-0.133		
									(0.101)		
WNP										0.948	0.578
										(0.101)	(0.096)
K2/NPW											0.502
											(0.068)

a/ WP/WEP instead of WPMH b/ W instead of WPMH c/ W/GRR2 instead of WPMH

Note: All variables in logarithms. See footnote under Table 6 for decoding the variable names.

TABLE 10

ESTIMATES OF ELASTICITY OF SUBSTITUTION : FURTHER RESULTS

Eqn.No. / Variable	2.5.3	2.5.4	2.5.5	2.6.6	2.6.7	2.6.8	2.6.9	2.6.10	2.6.11	2. .3	2.7.4
Dependent Variable	VA/N	VA/N	K2/N	VA/PWMH	VA/PWMH	VA/PW	VA/PW	VA/PWMH	VA/PW	VA/NPW	VA/NPW
				Less Capital Intensive Sector : No. of observations 640							
R^2	0.820	0.836	0.839	0.828	0.827	0.848	0.847	0.800	0.823	0.544	0.618
Constant	0.110	0.110	0.473	0.663	0.259	0.310	0.065	0.362	0.112	2.218	1.090
	(0.164)	(0.157)	(0.148)	(0.246)	(0.030)	(0.218)	(0.163)	(0.030)	(0.175)	(0.295)	(0.289)
$\bar{W}$	0.349	0.284		0.257a/	0.250a/	0.231b/	0.227b/	0.301a/	0.267b/	0.382c/	0.213c/
	(0.036)	(0.035)		(0.034)	(0.034)	(0.034)	(0.033)	(0.036)	(0.036)	(0.036)	(0.036)
$\bar{W}$/GRR2			0.121								
			(0.016)								
NPW/PWMH				0.040		0.041d/					
				(0.024)		(0.024)					
K2/PWMH				0.173	0.188	0.172e/	0.187e/				
				(0.021)	(0.019)	(0.021)	(0.019)				
K2/N		0.151									0.308f/
		(0.019)									(0.028)
Lagged Dependent Variable	0.678	0.580	0.832	0.600	0.606	0.602	0.610	0.760	0.764	0.485	0.413
	(0.027)	(0.028)	(0.018)	(0.023)	(0.023)	(0.028)	(0.028)	(0.024)	(0.024)	(0.030)	(0.028)
				Capital Intensive Sector : No. of observations 99							
R^2	0.808	0.818	0.765	0.807	0.807	0.820	0.820	0.794	0.808	0.784	0.790
Constant	1.242	0.957	2.064	0.545	0.294	1.194	1.155	0.553	1.479	0.844	-0.207
	(0.470)	(0.479)	(0.463)	(0.593)	(0.127)	(0.504)	(0.462)	(0.078)	(0.456)	(0.631)	(0.630)
$\bar{W}$	0.175	0.125		0.081a/	0.087a/	0.069b/	0.072b/	0.143a/	0.128b/	0.412c/	0.334c/
	(0.069)	(0.072)		(0.069)	(0.067)	(0.067)	(0.065)	(0.065)	(0.062)	(0.088)	(0.082)
$\bar{W}$/GRR2			0.215								
			(0.038)								
NPW/PWMH				0.027		0.012d/					
				(0.062)		(0.060)					
K2/PWMH				0.129	0.133	0.125e/	0.127e/				
				(0.053)	(0.052)	(0.052)	(0.051)				
K2/N		0.112									0.267f/
		(0.052)									(0.062)
Lagged Dependent Variable	0.722	0.672	0.612	0.662	0.657	0.689	0.687	0.717	0.747	0.599	0.467
	(0.048)	(0.052)	(0.044)	(0.051)	(0.050)	(0.052)	(0.051)	(0.045)	(0.046)	(0.058)	(0.062)

a/ WPMH and not $\bar{W}$ b/ WP and not $\bar{W}$ c/ WNP and not $\bar{W}$ d/ NPW/PW and not NPW/PWMH e/ K2/PW and not K2/PWMH f/ K2/NPW and not K2/N

Note: All variables in logarithms. See footnote under Table 6 for decoding the variable names.

that capital is cheap relative to foreign exchange resources. Employment, in this framework, is simply the residual resulting from the substitution of capital at home for foreign exchange resources, given the production techniques.

The second force responsible for the rise in the capital-labor ratio is the relative rise in the wage rate, relative to the price of capital (goods). Given a significant elasticity of substitution between capital and labor, probably of the order of unity, a rise in the wage rate relative to the price of capital implies a decrease in the employment of labor relative to that of capital. Further, it is shown that the relative employment of unskilled labor has decreased over time partly as a result of a rise in the relative wage rate of unskilled workers and partly due to the presence of complementarity between skilled labor and capital. Thus, unskilled labor (or the production workers), being the bulk of the labor force employed in the manufacturing sector, faced a decline in the demand for their services relative to that of skilled labor and capital.

Some preliminary estimates of the elasticity of substitution between capital and labor and between skilled and unskilled labor, as well as a test of the complementarity between skilled labor and capital, are presented in the paper. These results, based on the cross-sectional analysis of about 200 industry groups for the years 1960 through 1964, tend to support the findings reported above, based on the aggregate time-series data.

Finally, an attempt is made in the paper to develop a model, which will take care of the presence of developmental policies, for the purpose of estimating the long run parameters in the demand functions for labor.

The policy conclusions that emerge from this study are as follows:

i) Elimination of shortages which constrain the growth of output, and hence employment, in manufacturing;
ii) Flexibility in the foreign exchange policy with

view to encouraging the export of capital intensive products and easing the shortage of foreign exchange that is vital for manufacturing growth; iii) consistent with i) and ii) above, a re-allocation of capital and other resources in favor of the less capital intensive industries; and iv) creation of conditions for a fast rate of growth of investment in the labor force (i.e., productive capacity of the labor force). All these policies are desirable and capable of being implemented should we seek the goal of full employment in the long run.

TABLE I

KEY VARIABLES RELATING TO ALL MANUFACTURING : 1950-51 to 1968-69

Source	All Manufacturing	1950/51	1955/56	1960/61	1961/62	1962/63	1963/64	1964/65	1965/66	1966/67	1967/68	1968/69	(Compound rate of growth) 1950-64
1	1. Wholesale price of Manufacturing	100.0	96.6	120.0	122.7	124.8	127.0	133.0	144.6	157.9	160.4	163.4	2.1%
1	2. General Price level	100.0	82.7	111.7	111.9	114.4	121.0	136.6	147.7	171.1	190.0	188.0	2.3%
1	3. Consumer Price index	100.0	95.0	122.8	125.7	129.7	135.6	155.4	167.3	189.1	210.9	209.9	3.2%
2	4. Production worker wage rate	100.0	113.7	142.1	151.0	164.0	172.7	181.9					4.4%
2	5. Non-production worker wage rate	100.0	123.1	170.2	187.6	195.2	205.2	212.2					5.5%
1	6. Cost of fuel, power, lubricants, etc.	100.0	102.8	129.6	131.8	134.3	150.5	156.5	165.2	183.2	198.8	207.9	3.3%
1	7. Wholesale price of industrial raw materials	100.0	75.7	111.2	109.1	104.4	106.7	124.5	144.7	175.0	167.6	170.4	1.6%
1	8. Wholesale price of intermediate products	100.0	89.0	116.2	123.5	124.1	124.2	135.6	153.3	181.9	188.3	179.9	2.2%
1	9. Ratio of price of agricultural to non-agricultural commodities	100.0	93.8	101.1	99.7	96.0	97.7	107.0	107.9	110.9	110.8	109.6	
1	10. Wholesale price of food articles	100.0	77.0	106.7	106.8	112.1	121.6	142.1	150.0	177.7	215.3	205.6	2.5%
1	11. Industrial production (Revised Series)	100.0	136.0	187.1	204.3	223.9	242.6	263.6	287.5	285.1	283.2	301.0	7.2%
3	12. Price index of machinery and plants	100.0	121.9	142.5	162.4	167.7	168.2	173.4					4.0%
3	13. Price index of construction	100.0	103.2	124.7	166.6	172.4	177.0	170.3					3.9%
2	14. Number of Registered Firms	100.0	109.0	127.7	134.4	143.6	151.8	179.4					4.3%
2	15. Capital stock (current prices)	100.0	158.3	511.1	585.6	921.6	1105.8	1508.4					21.0%
2	16. Employment: production workers	100.0	105.1	170.7	181.2	191.0	200.3	215.2					5.6%
2	17. Employment: non-production workers	100.0	122.1	202.9	195.1	238.4	263.5	341.5					9.2%
2	18. Value added (current prices)	100.0	146.2	301.3	344.4	388.9	451.6	524.1					12.6%
2	19. Capital stock (current prices) per production worker	100.0	150.6	299.4	323.2	482.5	552.1	700.9					14.9%
2	20. Share of production worker wages in value added	53.6	44.0	43.2	42.7	43.2	41.2	40.2					
2	21. Share of non-production worker wages in value added	10.9	11.1	12.5	11.6	13.0	13.0	15.1					
	22. Value added per production worker at constant prices	100.0	144.0	147.1	154.9	163.2	177.5	183.1					
	23. Ratio of skilled to unskilled workers	100.0	116.2	113.9	105.4	124.8	131.6	158.7					4.4%
	24. Ratio of wage rate of skilled labor to that of unskilled	100.0	108.3	119.8	124.2	119.0	118.8	116.6					

Note: 'Unskilled' and 'skilled' labor are assumed to be equivalent to 'production' and 'non-production' workers, respectively. Sources of data are listed under Table VII. All indexes have been uniformly converted to 1950-51 base year.

TABLE II

KEY VARIABLES RELATING TO COTTON TEXTILES INDUSTRY : 1950-51 to 1968-69

Source	Cotton Textiles	1950/51	1955/56	1960/61	1961/62	1962/63	1963/64	1964/65	1965/66	1966/67	1967/68	1968/69	(Compound rate of growth) 1950-64
1	1. Wholesale price of Cotton Textiles	100.0	114.1	138.6	138.5	141.8	147.2	148.3	153.1	163.4	169.9	172.1	2.9%
1	2. General price level	100.0	82.7	111.7	111.9	114.4	121.0	136.6	147.7	171.1	190.0	188.0	2.3%
1	3. Consumer price index	100.0	95.0	122.8	125.7	129.7	135.6	155.4	167.3	189.1	210.9	209.0	3.2%
2	4. Production worker wage rate	100.0	107.3	142.7	148.6	169.1	176.4	188.3					4.7%
2	5. Non-production worker wage rate	100.0	106.8	138.3	160.2	182.1	190.1	187.8					4.6%
1	6. Cost of fuel, power, lubricants, etc.	100.0	102.8	129.6	131.8	134.3	150.5	156.5	165.2	183.2	198.8	207.9	3.3%
1	7. Wholesale price of cotton yarn	100.0	102.2	138.7	144.7	147.9	149.7	149.7	149.7	168.5	184.7	181.4	2.9%
1	8. Wholesale price of raw cotton	100.0	82.7	95.5	93.1	96.5	101.6	107.6	110.3	118.7	135.8	148.6	0.5%
1	9. Index of production: Cotton textiles	100.0	124.4	134.5	141.0	140.4	141.9	151.7	150.1	143.2	141.1	150.2	3.0%
3	10. Price index of machinery and plant	100.0	121.9	142.5	162.4	167.7	168.2	173.4					4.0%
3	11. Price index of construction	100.0	103.2	124.7	166.6	172.4	177.0	170.3					3.9%
2	12. Number of registered firms	100.0	95.4	95.0	96.9	103.3	105.0	114.3					1.0%
2	13. Capital stock (current prices)	100.0	155.7	249.6	295.8	333.7	373.7	413.0					10.7%
2	14. Employment: production workers	100.0	104.7	108.2	117.9	113.8	111.0	114.0					1.0%
2	15. Employment: non-production workers	100.0	144.0	135.8	123.3	120.9	123.6	166.6					3.7%
2	16. Value added (current prices)	100.0	135.0	170.4	201.0	196.5	198.3	219.2					5.8%
2	17. Capital stock (current prices) per production worker	100.0	148.7	230.7	250.9	293.2	336.7	362.3					9.6%
2	18. Share of production worker wages in value added	66.6	55.5	60.4	58.1	65.2	65.8	65.3					
2	19. Share of non-production worker wages in value added	7.8	8.9	8.6	7.7	8.7	9.2	11.1					
	20. Value added per production worker at constant prices	100.0	113.0	113.6	123.1	121.8	121.3	129.6					
	21. Ratio of skilled to unskilled workers	100.0	137.5	125.5	104.6	106.2	111.4	146.1					1.9%
	22. Ratio of wage rate of skilled labor to that of unskilled	100.0	99.5	96.9	107.8	107.7	107.8	99.7					

Note: See footnote for Table I.

TABLE III

KEY VARIABLES RELATING TO JUTE TEXTILE INDUSTRY : 1950-51 to 1968-69

Source	Jute Textiles	1950/51	1955/56	1960/61	1961/62	1962/63	1963/64	1964/65	1965/66	1966/67	1967/68	1968/69	(Compound rate of growth) 1950-64
1	1. Wholesale price of Jute Textiles	100.0	72.3	98.9	91.8	83.5	75.2	85.8	109.8	114.4	97.8	122.6	-1.1%
1	2. General price level	100.0	82.7	111.7	111.9	114.4	121.0	136.6	147.7	171.1	190.0	188.0	2.3%
1	3. Consumer price index	100.0	95.0	122.8	125.7	129.7	135.6	155.4	167.3	189.1	210.9	209.9	3.2%
2	4. Production worker wage rate	100.0	119.8	142.8	136.9	152.0	161.6	182.2					4.4%
2	5. Non-production worker wage rate	100.0	119.7	136.9	143.2	146.4	156.4	185.9					4.5%
1	6. Cost of fuel, power, lubricants etc.	100.0	102.8	129.6	131.8	134.3	150.5	156.5	165.2	183.2	198.8	207.9	3.3%
1	7. Wholesale price of raw jute	100.0	87.1	156.3	132.3	109.3	110.0	121.9	162.9	197.8	156.9	220.8	1.4%
1	8. Index of production: jute textiles	100.0	124.5	132.2	117.8	146.5	157.0	152.2	159.0	132.7	137.6	127.4	3.0%
3	9. Price index of machinery and plant	100.0	121.9	142.5	162.4	167.7	168.2	173.4					4.0%
3	10. Price index of construction	100.0	103.2	124.7	166.6	172.4	177.0	170.3					3.9%
2	11. Number of registered firms	100.0	104.7	88.8	89.8	89.8	91.6	87.8					-0.9%
2	12. Capital stock (current prices)	100.0	133.8	139.7	140.7	147.0	173.2	188.8					4.6%
2	13. Employment: production workers	100.0	92.1	76.8	76.2	82.0	86.5	86.2					-1.0%
2	14. Employment: non-production workers	100.0	96.6	96.5	86.1	88.4	103.4	105.7					0.6%
2	15. Value added (current prices)	100.0	101.5	105.3	94.7	159.6	169.0	156.0					3.2%
2	16. Capital stock (current prices) per production worker	100.0	145.3	181.9	184.6	179.3	200.2	219.0					5.8%
2	17. Share of production worker wages in value added	70.9	70.8	67.8	71.7	50.8	53.9	65.6					
2	18. Share of non-production worker wages in value added	9.3	10.4	11.5	11.9	7.4	8.8	11.5					
	19. Value added per production worker at constant prices	100.0	152.4	138.6	135.4	233.0	259.8	210.9					5.5%
	20. Ratio of skilled to unskilled workers	100.0	104.9	125.6	113.0	107.8	119.5	122.6					
	21. Ratio of wage rate of skilled labor to that of unskilled	100.0	99.9	95.9	104.6	96.3	96.8	102.0					

Note: See footnote for Table I.

TABLE IV

KEY VARIABLES RELATING TO SUGAR INDUSTRY: 1950-51 to 1968-69

Source	Sugar	1950/51	1955/56	1960/61	1961/62	1962/63	1963/64	1964/65	1965/66	1966/67	1967/68	1968/69	(Compound rate of growth) 1950-64
1	1. Wholesale price of sugar	100.0	94.9	128.3	126.3	132.3	140.4	152.5	154.5	164.6	185.8	201.0	3.1%
1	2. General price level	100.0	82.7	111.7	111.9	114.4	121.0	136.6	147.7	171.1	190.0	188.0	2.3%
1	3. Consumer price index	100.0	95.0	122.8	125.7	129.7	135.6	155.4	167.3	189.1	210.9	209.9	3.2%
2	4. Production worker wage rate	100.0	144.3	214.6	257.9	278.2	296.5	307.0					8.3%
2	5. Non-production worker wage rate	100.0	136.2	169.9	190.9	217.1	234.8	247.9					6.7%
1	6. Cost of fuel, power, lubricants, etc.	100.0	102.8	129.6	131.8	134.3	150.5	156.5	165.2	183.2	198.8	207.9	3.3%
1	7. Wholesale price of Gur	100.0	44.3	70.1	59.8	78.9	112.4	108.2	83.5	108.8	236.1	216.5	0.6%
1	8. Index of production: sugar	100.0	163.3	257.5	283.2	278.4	229.7	261.1	321.1	334.2	216.3	217.6	7.1%
3	9. Price index of machinery and plant	100.0	121.9	142.5	162.4	167.7	168.2	173.4					4.0%
3	10. Price index of construction	100.0	103.2	124.7	166.6	172.4	177.0	170.3					3.9%
2	11. Number of registered firms	100.0	98.7	116.0	116.7	121.2	122.0	133.0					2.1%
2	12. Capital stock (current prices)	100.0	138.5	371.2	409.9	450.7	474.2	537.2					12.8%
2	13. Employment: production workers	100.0	111.2	101.5	109.8	107.9	89.7	96.6					0.2%
2	14. Employment: non-production workers	100.0	100.6	124.4	122.7	126.9	120.9	134.1					2.1%
2	15. Value added (current prices)	100.0	159.7	209.8	253.4	241.7	205.2	244.4					6.6%
2	16. Capital stock (current prices) per production worker	100.0	124.6	365.7	373.3	417.7	528.6	556.1					13.0%
2	17. Share of production worker wages in value added	29.0	27.2	28.1	30.3	33.7	35.1	32.9					
2	18. Share of non-production worker wages in value added	12.9	10.4	12.2	11.1	13.7	16.8	16.4					
	19. Value added per production worker at constant prices	100.0	151.3	161.1	182.7	169.3	162.9	165.9					3.7%
	20. Ratio of skilled to unskilled workers	100.0	90.5	122.6	111.7	117.6	134.8	138.8					
	21. Ratio of wage rate of skilled labor to that of unskilled	100.0	94.4	79.2	74.0	78.0	79.2	80.7					

Note: See footnote for Table I.

TABLE V

KEY VARIABLES RELATING TO PAPER AND PAPER BOARDS INDUSTRY: 1950-51 to 1968-69

Source	Paper and Paper Products	1950/51	1955/56	1960/61	1961/62	1962/63	1963/64	1964/65	1965/66	1966/67	1967/68	1968/69	(Compound rate of growth) 1950-64
4	1. Wholesale price of paper and paper products	100.0	113.1	151.3	157.8	167.5	170.2	176.9					4.2%
1	2. General price level	100.0	82.7	111.7	111.9	114.4	121.0	136.6	147.7	171.1	190.0	188.0	2.3%
1	3. Consumer price index	100.0	95.0	122.8	125.7	129.7	135.6	155.4	167.3	189.1	210.9	209.9	3.2%
2	4. Production worker wage rate	100.0	114.4	152.0	168.1	170.7	184.2	194.4					4.9%
2	5. Non-production worker wage rate	100.0	115.2	135.9	145.9	146.7	157.1	167.0					3.7%
1	6. Cost of fuel, power, lubricants, etc.	100.0	102.8	129.6	131.8	134.3	150.5	156.5	165.2	183.2	198.8	207.9	3.3%
1	7. Index of production of paper products	100.0	169.8	307.0	324.8	335.8	399.7	421.5	451.9	491.2	513.0	568.0	10.8%
3	8. Price index of machinery and plant	100.0	121.9	142.5	162.4	167.7	168.2	173.4					4.0%
3	9. Price index of construction	100.0	103.2	124.7	166.6	172.4	177.0	170.3					3.9%
2	10. Number of registered firms	100.0	133.9	195.9	208.3	270.4	297.6	362.1					9.6%
2	11. Capital stock (current prices)	100.0	192.2	674.2	682.2	879.7	1039.3	1277.6					20.0%
2	12. Employment: production workers	100.0	129.3	221.0	221.8	238.2	259.9	269.5					7.3%
2	13. Employment: non-production workers	100.0	164.0	318.5	233.6	333.2	412.8	463.3					11.6%
2	14. Value added (current prices)	100.0	214.7	343.3	370.9	435.4	525.8	578.5					13.4%
2	15. Capital stock (current prices) per production worker	100.0	148.6	305.1	307.6	369.3	400.0	474.1					11.8%
2	16. Share of production worker wages in value added	35.2	23.8	33.4	34.6	32.2	31.4	31.2					
2	17. Share of non-production worker wages in value added	12.6	10.8	15.9	13.8	13.8	15.2	16.5					
2	18. Value added per production worker at current prices	100.0	146.8	102.7	106.0	109.1	118.9	121.3					1.4%
	19. Ratio of skilled to unskilled workers	100.0	126.8	144.1	127.9	139.9	158.8	171.9					
	20. Ratio of wage rate of skilled to that of unskilled	100.0	100.7	89.4	86.8	85.9	85.3	85.9					

Note: See footnote for Table I.

TABLE VI

KEY VARIABLES RELATING TO CEMENT INDUSTRY : 1950-51 to 1968-69

Cource	Cement	1950/51	1955/56	1960/61	1961/62	1962/63	1963/64	1964/65	1965/66	1966/67	1967/68	1968/69	(Compound rate of growth) 1950-64
4	1. Wholesale price of cement	100.0	117.8	131.7	149.4	163.0	162.2	170.4					3.9%
1.	2. General price level	100.0	82.7	111.7	111.9	114.4	121.0	136.6	147.7	171.1	190.9	188.0	2.3%
1	3. Consumer price index	100.0	95.0	122.8	125.7	129.7	136.6	155.4	167.3	189.1	210.9	209.9	3.2%
2	4. Production worker wage rate	100.0	148.4	180.0	215.2	229.1	249.9	269.3					7.3%
2	5. Non-production worker wage rate	100.0	155.2	187.3	209.8	241.3	247.2	256.2					7.0%
1	6. Cost of fuel, power, lubricants, etc.	100.0	102.8	129.6	131.8	134.3	150.5	156.5	165.2	183.2	198.8	207.9	3.3%
1	7. Index of production of cement	100.0	171.6	295.5	310.6	323.6	352.5	364.9	398.3	416.6	425.2	450.0	9.7%
3	8. Price index of machinery and plant	100.0	121.9	142.5	162.4	167.7	168.2	173.4					4.0%
3	9. Price index of construction	100.0	103.2	124.7	166.6	172.4	177.0	170.3					3.9%
2	10. Number of registered firms	100.0	159.6	191.5	210.7	217.1	229.8	236.2					6.3%
2	11. Capital stock (current prices)	100.0	253.4	542.5	544.6	528.6	563.9	628.4					14.0%
2	12. Employment: production workers	100.0	115.3	150.9	156.8	157.7	165.4	172.6					4.0%
2	13. Employment: non-production workers	100.0	141.1	246.6	221.9	234.1	230.3	264.4					7.2%
2.	14. Value added (current prices)	100.0	216.4	258.8	342.5	363.6	387.0	369.2					9.8%
2	15. Capital stock (current prices) per production worker	100.0	219.8	359.4	347.3	335.2	340.9	364.1					9.7%
2	16. Share of production worker wages in value added	28.0	20.5	27.2	30.0	25.7	27.6	32.6					
2	17. Share of non-production worker wages in value added	8.4	8.3	14.6	13.0	12.8	12.1	15.0					
	18. Value added per production worker at constant prices	100.0	159.3	130.2	146.2	141.[illegible]	144.2	125.5					1.7%
	19. Ratio of skilled to unskilled workers	100.0	122.4	163.4	141.5	148.4	139.2	153.2					
	20. Ratio of wage rate of skilled to that of unskilled	100.0	104.6	104.0	97.5	105.3	98.9	95.1					

Note: See footnote for Table I.

TABLE VII

KEY VARIABLES RELATING TO GLASS AND GLASSWARE INDUSTRY : 1950-51 to 1968-69

Source	Glass and Glassware	1950/51	1955/56	1960/61	1961/62	1962/63	1963/64	1964/65	1965/66	1966/67	1967/68	1968/69	(Compound rate of growth) 1950-64
2	1. Wholesale price of glass products												
1	2. General price level	100.0	82.7	111.7	111.9	114.4	121.0	136.6	147.7	171.1	190.0	188.0	2.3%
1	3. Consumer price index	100.0	95.0	122.8	125.7	129.7	135.6	155.4	167.3	189.1	210.9	209.9	3.2%
2	4. Production worker wage rate	100.0	111.6	164.6	172.8	187.9	203.3	220.3					5.8%
2	5. Non-production worker wage rate	100.0	132.5	170.7	192.8	201.8	239.4	245.3					6.6%
1	6. Cost of fuel, power, lubricants, etc.	100.0	102.8	129.6	131.8	134.3	150.5	156.5	165.2	183.2	198.8	207.9	3.3%
3	7. Price index of machinery and plant	100.0	121.9	142.5	162.4	167.7	168.2	173.4					4.0%
3	8. Price index of construction	100.0	103.2	124.7	166.6	172.4	177.0	170.3					3.9%
2	9. Number of registered firms	100.0	91.1	89.2	84.7	94.4	99.5	114.4					1.0%
2	10. Capital stock (current prices)	100.0	170.9	184.6	254.6	319.5	392.6	494.2					12.1%
2	11. Employment: production workers	100.0	118.4	155.3	161.6	174.1	185.9	193.6					4.8%
2	12. Employment: non-production workers	100.0	120.8	137.4	133.7	164.9	167.0	232.6					6.2%
2	13. Value added (current prices)	100.0	176.6	368.0	400.0	444.6	473.0	516.4					12.5%
2	14. Capital stock (current prices) per production worker	100.0	144.3	118.9	157.5	183.5	211.2	255.3					6.9%
2	15. Share of production worker wages in value added	72.8	57.8	53.7	54.0	56.8	61.9	63.8					
2	16. Share of non-production worker wages in value added	15.0	14.3	10.0	10.1	11.8	13.2	17.3					
	17. Value added per production worker at constant prices	100.0	102.0	88.5	82.7	94.7	89.8	120.1					
	18. Ratio of skilled to unskilled workers	100.0	118.7	103.7	111.6	107.4	117.4	111.3					
	19. Ratio of wage rate of skilled to that of unskilled												

Note: See footnote for Table I.

Sources for Appendix Tables I through VII:

1. Report on Currency and Finance, RBI, Bombay (Annuals).

2. Census of Indian Manufactures, CSO, New Delhi (Annuals upto 1958). and Annual Survey of Industries (Census Sector), CSO, New Delhi. (Annuals)

3. Banerji, Asit, Capital Intensity and Economic Efficiency in Indian Industry. (unpublished Ph.D. dissertation), University of Delhi, August 1969, Table A.14.

4. Estimated from value of output in Source 2 above and quantity in Source 1 above.

TABLE VIII

INDEX OF RATE OF RETURN ON CAPITAL IN SELECTED MANUFACTURING INDUSTRIES, 1951-65*

	Cotton Textiles	Jute Textiles	Sugar	Paper & Paper Boards	Cement
1951	100.0	100.0	100.0	100.0	100.0
1952	42.5	61.0	81.7	91.4	96.5
1953	54.2	59.6	104.8	89.3	85.9
1954	55.0	58.8	88.5	71.4	101.4
1955	90.0	45.6	95.2	87.1	101.4
1956	76.8	**	104.1	76.1	75.1
1957	25.6	54.9	105.3	68.8	58.6
1958	34.9	94.7	103.0	89.3	55.6
1959	63.6	92.2	114.2	87.8	59.3
1960	91.0	92.8	99.8	69.1	63.0
1961	97.8	41.5	83.9	61.8	66.0
1962	60.3	196.2	83.0	60.9	86.4
1963	66.9	129.2	123.8	57.8	76.4
1964	65.7	63.7	119.6	48.6	74.8
1965	43.9	75.9	109.2	56.5	84.0

* Rate of return is defined as the ratio of gross profits (= profits before tax, interest and managing agents remuneration but excluding depreciation) to total capital employed (= total net assets plus working capital).

** Negative

Source: Computed from Reserve Bank of India Bulletins, October 1958, December 1963 and February 1968.

List of Industries where capital employed per worker is over Rs. 15,713 in 1964*:

1. Milk foods and malted foods.
2. Breweries and manufacturing of malt.
3. Pulp, woodpulp, mechanical, chemical including dissolving pulp etc.
4. Hardboard including fire board and chip board.
5. Tyres and tubes.
6. Inorganic fertilizers.
7. Heavy chemicals inorganic.
8. Heavy chemicals organic.
9. Synthetic resins and plastics and synthetic rubber.
10. Manmade fibres including cellulose, rayon, nylon, etc.
11. Explosives including gun powder and safety fuses.
12. Dye-stuffs.
13. Terpentine and rosin; products of fermentation industries other than alcohol and other basic industrial chemicals.
14. Textile auxiliaries and sizing materials.
15. Petroleum refineries.
16. Manufacture of miscellaneous products of petroleum and coal.
17. Manufacture of cement (hydraulic).
18. Grinding wheels and abrasives.
19. Iron and steel.
20. Ferro alloys.
21. Non-ferrous basic metal industries.
22. Ball, roller and tapered bearings.
23. Manufacture of machinery (except electrical machinery).
24. Equipment for generation, transmission and distribution of electricity including transformers.
25. Electrical cables and wires.
26. Manufacture of aircrafts.

*Capital defined as the sum of fixed capital and half of the working capital. Workers include both production and non-production workers.

FOOTNOTES

1/ A factory is a manufacturing unit which employs ten or more workers with the aid of power or twenty or more workers without the aid of power.

2/ Central Statistical Organization, Department of Statistics, "Brochure on Revised Series of National Product for 1960-61 to 1964-65," New Delhi, August, 1967, p. 81.

3/ Central Statistical Organization, Department of Statistics, "Annual Survey of Industries, 1964 - Capital, Employment, Output Estimates for Factory Sector by Capital Size", New Delhi, January 1968, p. iv.

4/ Central Statistical Organization, Department of Statistics, "Estimates of National Product(Revised Series), 1960-61 to 1966-67", New Delhi, October, 1967, p. 6.

5/ The Census Sector covers all registered factories which employ 20 or more workers with the aid of power (till 1958); and 50 (or more) workers with the aid of power or 100 (or more) workers without the aid of power (since 1959).

6/ Throughout this paper, by "manufacturing sector" we mean the 'large scale manufacturing sector' or the 'census sector' unless otherwise specified.

7/ Where data were available, the period is extended to 1968-69.

8/ Compound rate of growth is computed (owing to time constraint) by taking the figures for the end points of the period instead of estimating the trend coefficient from an equation of the form $\log y = a + bt$ where y is the variable concerned and t is the time trend.

8a/ No attempt is made in this paper to construct a price index for capital goods. See the list of sources of data following Appendix Tables I through VII for the source from which the price indexes for machinery and equipment and construction are borrowed.

9/ It is quite likely that the process of acquiring the ration is subject to economies of scale in the sense that larger firms have a certain advantage over the smaller ones.

10/ The words "firm" and "factory" are used interchangeably throughout this paper.

11/ Planning Commission, Government of India, "Third Five Year Plan", New Delhi, 1961, p. 458.

12/ Assuming that there was no appreciable change in the "service life" of capital, the movements in the price of capital can be taken to indicate the corresponding movements in the "rental" on capital per unit of time.

13/ It is not actually the rate of return in the sense it is a ratio of rental to capital. See footnote to Appendix Table VIII.

14/ See Banerji, Asit, "Capital Intensity and Economic Efficiency in Indian Industry", (unpublished Ph.D. dissertation) University of Delhi, Delhi, 1969, p. 78.

15/ Production worker is one who is employed directly or through any agency whether for wages or not, in any manufacturing process, or in cleaning any part of the machinery or premises used for a manufacturing process, or in any other kind of work incidental to or connected with manufacturing process. Workers other than production workers are defined as 'non-production' workers which includes mainly persons holding positions of supervision or management.

16/ It is not clear from the data whether the faster rate of growth in demand for non-production workers was partly in response to Corporate Income Tax regulations. For example, we do not know what part of such wage compensation, if any, should really be treated as a part of the return on capital.

17/ See footnote 15/.

18/ In the following analysis electricity, light and power (generation, transmission and distribution), and gas manufacture and distribution industry, are deleted.

19/ See section IV of the paper for a further discussion on this.

20/ This assumption may not hold for some industries as some of the empirical studies cited below have shown.

21/ This assumption is reasonable so long as either perfect competition prevails in all the markets or the firms are operating in a world of administered prices. Possible exception to this may arise if the capital market is imperfect. But this problem is taken care of as the discussion below will show.

22/ See Sethuraman, S.V., "Long Run Demand for Draft Animals in Indian Agriculture", (unpublished Ph.D. dissertation, University of Chicago, 1969) for further discussion on this point and the model.

23/ See Sethuraman, S.V., "Long Run Demand for Draft Animals in Indian Agriculture", p. 10.

24/ See section III of the paper.

25/ See Zvi Griliches, "Specification Bias in Estimates of Production Functions", Journal of Farm Economics, February 1957.

26/ See S.V. Sethuraman, "Long Run Demand for Draft Animals in Indian Agriculture," page 10.

27/ Arrow, K.J., H.B. Chenery, B.S. Minhas and R.M. Solow, "Capital-Labor Substitution and Economic Efficiency", Review of Economics and Statistics, 63 (1961).

28/ See Banerji, Asit, "Capital intensity and Economic Efficiency in Indian Industry", p. 74-75.

29/ See Sankar, U., "Production Functions in Indian Manufacturing Industries: Implications for Economic Development", (unpublished Ph.D. dissertation, University of Wisconsin, 1967). See also Sankar U., and Chetty, V.K., "Size, Technology and Efficiency in Indian Manufacturing Industries", paper presented at the Northern American Regional Conference of the Econometric Society, Washington, D.C. 1967.

30/ The results presented here are based on the regressions 2.1.5, 2.1.9, 2.2.2, 3.1.5, 3.1.9 and 3.2.2, which seem to fit the data better.

31/ See Zvi Griliches, "Specification Bias in Estimates of Production Functions", op.cit., for the method of evaluating the bias.

32/ "Fourth Five Year Plan, 1969-74", Planning Commission, Government of India, New Delhi, May 1970, p. 38.

33/ See, for example, "Fourth Five Year Plan, 1969-74", pages 296-297; Koti, R.K., "Utilization of Industrial Capacity in India, 1967-68", Gokhale Institute of Politics and Economics, Poona 1968; and many others for a description of the constraints on the supply side.

34/ "Fourth Five Year Plan, 1969-74", Planning Commission, p. 303.

35/ As a matter of fact, a policy to produce capital

goods at home does not guarantee that the scarcity of foreign exchange will be eliminated; on the contrary, as the Indian experience shows, it accentuates the demand for imports of certain types of inputs and raw materials needed in the production of capital goods. (The author is thankful to Prof. Anne Krueger for pointing this out).

THE GREEN REVOLUTION AND ITS IMPACT ON EMPLOYMENT IN THE TERTIARY SECTOR:1/ A CASE STUDY IN PUNJAB AND HARYANA

S. D. Thapar

I. Introduction
II. Methodological Notes
III. Selected Parameters of the Blocks
IV. Employment in Engineering Workshops
V. Employment in Commerce and Trade
VI. Employment in Transportation
VII. Supporting Services
VIII. Total Tertiary Sector Employment
IX. Evaluation
X. Statistical Appendix

I. INTRODUCTION

This note is concerned with the impact on employment in the tertiary sector of the technical changes comprising the use of agricultural machinery and other infra-structure going along with the use of high yielding varieties and forming a part of the green revolution. How much more or less employment agriculture will generate as a result of the new technology is a separate issue, depending upon a number of factors like size of farm, the comprehensiveness of measures involved in improving agriculture, the pace at which contractual changes in land ownership as well as farming practices are taking place, and the time factor. Some exploratory work in this field has already been started in various institutions. But the new agriculture has a few more facts at the local level; in terms of employment opportunities, and the style of life. And, it will be of interest to closely watch conditions as they develop.

The scope of this note is very limited. It is a case

1/ Trade, commerce and services.

study of four selected blocks describing the employment situation in respect of the tertiary/service sector, with information gathered during the month of May 1970. Obviously, the use of new machinery on the farm would make a call on supporting staff by way of its maintenance. This is independent of the employment generated by way of the manufacture of such equipment; the services covered here are repairs and replacement of parts. Similarly, the use of improved seeds and fertilizers would require some distribution outlets in shops, depots and/or mobile agents and suppliers. The employment provided by these outlets is different from that which is generated by way of an increased pressure on distribution outlets arising from the supply of more and/or new consumer goods consequent to the rise in incomes. Work would also be created for electricians and mechanics to keep the irrigation system going.

The need for a few local, small, rural industries to handle increased agricultural production can also be visualized. Storage, warehousing, milling, packing (such as bailing of cotton), and sorting of grains have variously been described as industrial activities although very little value is added by them. Transport would also be stimulated and the spill over employment through this would be substantial.

A few shops would be the outgrowth of increased agricultural production, adding to the employment in the tertiary sector. And so would be the case of a few financial institutions and other allied institutions.

It is proposed to review the gamut of all these activities over a period of time, since the inception of the new agriculture. The growth in these activities may be related to the intensity of the new agricultural practices, severally and jointly as described by a suitable index. In addition, a few technical co-efficients can be worked out, such as: how many persons are needed to keep in use one tractor on the farm; how many persons get employment in commerce and transport with every extra truck load of food grain produced; the number of jobs generated in the tertiary sector with every one acre of land brought under High Yielding Varieties (HYV).

The study is more of an exploratory nature; finding out the nature of factors involved, and the availability of data required to reach firm conclusions. A Community Development Block was considered to be a convenient unit of inquiry, as the required information at this level was easy to comprehend. The four blocks selected for case studies represent different situations. Ballabgarh block has the distinction of being in the proximity of the Delhi metropolis. Fatehabad has the benefit of canal irrigation facilities. Nakodar, in addition to canal irrigation, has a large privately owned irrigational system through tubewells. Kapurthala has an assured irrigation, but faces keen competition from Jullundur as regards the development of its tertiary sector. Whereas Ballabgarh and Fatehabad are in Haryana, Nakodar and Kapurthala are in the Punjab.

II. METHODOLOGICAL NOTES

Four groups of persons have been interviewed. The background information about the block, especially aggregates regarding area under HYV, the status of irrigation, agricultural equipment and fertilizer distribution, was collected from the Block Development Officers. In addition the Block Development Officers' were asked to brief the author about the marketing and servicing facilities in the blocks. They also informed him about the opening of new markets; gave names of knowledgeable persons in the markets; of important workshops and the progressive farmers. These lists made the sampling frame for subsequent visits and interviews.

There is seasonality in the type of jobs generated in the tertiary sector consequent to the green revolution.2/ The sale of seeds and fertilizers observes the agricultural cycle. And so do the operations of commission agents, and of wholesalers of agricultural produce. The 'Green Revolution',

2/ Throughout the discussion one broad assumption made is that increase in production through traditional agriculture stays put.

till lately,is largely a wheat and maize revolution. The time these crops arrive in the market marks the busiest months for those engaged in commerce and transport. Similarly work relating to over-hauling and servicing of mechanical equipment arises in months immediately after harvest.

The method followed to estimate the number of jobs generated consequent to the 'green revolution' involves two steps: First, to estimate average additional jobs (1970 over 1966), both in the busy and slack seasons and,secondly, to calculate a weighted average giving weights depending upon the length of the two periods. For estimating the number of jobs in commerce and trade the weighting system used is 1 for the busy season and 2 for the slack season. This is based on the examination of data on commodity arrivals and disposals in the surveyed markets. And for employment in tractor repair and maintenance jobs, 5 for the busy season and 7 for the slack season, depending upon the duration of the two periods. Using this method, estimates of additional employment were made right away at the time of interview and the concurrence of the informants was sought.

Employment in transportation has two categories; those engaged in the actual operating of vehicles and their servicing including mechanics and spare parts dealers all described as transport operators, and those doing loading and unloading work. It is difficult to make a precise estimate of the new jobs of transport operators treated consequent to the new agriculture. The general view is that very few new trucks might have been added to the block lot and therefore very few drivers might have been recruited. However, there was local concurrence on a rough and ready method, assuming that the new jobs of transport operators were equal to the number of new agricultural produce shops that have come up. The second category of jobs, that of loading and unloading, covered under transportation are known as 'palladars' in the local parlance. While the jobs arising in the first category are of a continuous nature, the

second category represents seasonal work. The average employment opportunities for 'palladars' over the year are estimated in the same manner as for those engaged in trade and commerce, that is, by giving weights by the length of the busy and slack seasons.

Improvement in agricultural practices covers the use of improved implements, as well as mechanization through tractors, threshers and combines. The 'green revolution' has brought in expansion in both these directions. But, by and large, both administrators and cultivators associate the success of the green revolution' with tractorization. It is said that the use of the iron plough, disc harrows, levellers, spray pumps, etc. was even otherwise increasing. But it is the coming in of HYV that has increasingly made obvious the usefulness of tractors and threshers. Combines are another necessity (though a long way away yet) due to the peculiarities of Indian agriculture with only a few large farms and limited investible funds. In view of these considerations, a tractor was considered as a symbol of the new agriculture, and the present inquiry dwelt more on the employment potentials of tractors than on any other agricultural equipment.

With due limitations, it is assumed that branch banking has been largely influenced by the new agriculture since 1966. The users of HYV would need financial accommodation, and the banks in turn find bankable clients. In the same fashion, the opening up of new petrol pumps since 1966 has been counted as the spill-over effect of the 'green revolution'. The depots selling seeds and fertilizers have a mixed employment potential. In the initial stages of the 'green revolution' there would be need for more and more outlets to distribute seeds. But after some time, when the agricultural land is about saturated with HYV, much of the supply of seeds is obtained from multiplication on farms. Although fertilizers continue to be distributed through depots and private shops, work connected with this is not considered sufficient to call forth much increase in either the number of outlets and/or additional jobs. The general view in the four blocks visited is that there is little scope for further employment through such outlets. The sale of pesticides, which is still a long way

behind, when done through such outlets would change the position.

In the four blocks visited, the selling of spare parts is combined with either servicing work or with the sale of motor parts. Assuming that any discrepancy involved would be insignificant, the entire increased employment through such mixed workshops is attributed to the 'green revolution'. Similarly, any extra hand employed in the area of agricultural extension in the block office is considered to be the result of the 'green revolution'. Assuredly a few extension agents work for the private sector, but their field of operation is much larger than a block, and it is difficult to apportion their time to a single block.

Tubewell maintenance by itself does not create many jobs. Even the boring part of it is gradually decreasing. Outside the small towns ('mandi' areas included), electricity is largely used for tubewell operations, and very little for household lighting. Work connected with that has, therefore, not generated many private jobs. The electricity department maintains a few distribution centers and sub-centers. All those who have found jobs in these centers since 1966, have been counted as servicemen of tubewells and thus beneficiaries of the 'green revolution'.

The industries based on agricultural produce may be classified into two parts; those which are located locally, and others. Warehousing, which belongs to the first category, has yet to be developed in the blocks visited. In the 'mandi' areas of the two blocks a few food processing units have come up, but in the remaining two little activity in that direction is visible. One could look at the future possibilities of employment through such industries even at the local level. Here, no such attempt has been made. A convenient co-efficient like the one relating to the area under HYV, with the employment in agro-based industries, on either the state or the all-India scale, could appropriately help any one interested in computing such a figure.

To establish a counter-check on the figures for employment in tractor repair and maintenance, cultivators (four in each

block) were asked about their total expenditure on the upkeep of tractors. Applying to these figures the average wage rate for skilled and semi-skilled mechanics, the number of man-days arising out of such work were estimated.

It is likely that increased employment in the tertiary sector would be a function of a number of variables including the original socio-economic status of a block, density of population, the urban-rural configuration of the population, proximity to major business and/or industrial towns etc. But, for the preliminary exercise made here, their effect has not been studied.

It has not been possible to collect blockwise data on agricultural produce. The crop cutting surveys for the estimation of yields, or even the official estimates of agricultural produce, do not go below the district level. It has, therefore, not been possible to establish any relationship between the tertiary sector employment and agricultural produce.

III. SELECTED PARAMETERS OF THE BLOCKS

Table I presents a few selected statistics on blocks which are likely to reflect upon the employment situation. No data are available to indicate the blockwise distribution of the work force and, therefore, any relationship between the new employment opportunities and the increase in manpower supply can be established only on very broad assumptions.

The 'green revolution', represented by the use of HYV, has gone fast in Kapurthala and Nakodar, where in the course of the last four years 80 to 90 per cent of the cultivated areas has experienced such a change. Compared to this, in Ballabgarh and Fatehabad, till recently a little over one-fourth of the cultivated area was sown with HYV.

As regards the availability of tractors, land in Punjab is about 3 to 4 times more tractorized than in Haryana. However, assuming that tractors are primarily used for HYV lands,

there is one tractor to every 250 acres in Ballabgarh, to every 440 acres in Fatehabad, to every 370 acres in Kapurthala and to every 270 acres in Nakodar. And, as the size of farms on the whole is not very large and the workload per tractor is said to be low, the inference is that quite a substantial portion of the area under HYV is not tractorized.

Table II sets out increases in the area under HYV and the corresponding increase in the number of tractors in the blocks during 1966 to 1970. It is seen that Kapurthala, with an increase of 65,000 acres under HYV, added 151 tractors to its fleet. Compared to that the increase in the number of tractors in Ballabgarh has been minimal. One possible explanation for this variation may be found in the intensity of land-use represented by the percentage area under irrigation in the two blocks and secondly, the original stock of tractors in a place reflects on the marginal annual addition.

IV. EMPLOYMENT IN ENGINEERING WORKSHOPS

Table III shows estimates of increased employment in different job categories during 1966-70. It is seen that employment in engineering shops bears little relationship to either the number of tractors in use or the area under HYV. The most important single factor governing expansion in this field is the distance from some major city and/or manufacturing centre. The proximity to Jullundur (11 miles) is not allowing any tractor repair shops to come up in Kapurthala. A customer wants all sorts of facilities at the same place plus the availability of varied skills, which smaller places can ill afford.

As already mentioned in Section 2, an attempt was made to estimate the number of tractor mechanic jobs through farmers' expenditure on maintenance and repairs. As a result of 12 interviews in four blocks, it is estimated that an average farmer spends about Rs.3,000 per annum per tractor on repairs and replacement of parts. It is also estimated that an average skilled worker earns about Rs.6.50 per day. On the assumption that a worker works for 300 days per year, one day estimate that one tractor gives rise to 1.5 full time jobs through a year.

Table IV presents a few accepted co-efficients of employment based on the results of the survey. It is seen that as against the figure of 1.5 full time men employed per tractor estimated through expenditure on maintenance, the figure given is lower, that is one man to a tractor. The majority of informants believe that with experience they would be able to cut down on depreciation, and this suggests that a co-efficient of 1.5 off-farm jobs per tractor is optimistic. Similarly, the figure of 0.5 per person based on the actual count is considered too low. The general concensus is that one person to a tractor is realistic. One reason for the low figure on actual count is that the tractors in Punjab and Haryana are rather new and the service requirements are lower that what will be required in their life time.

V. EMPLOYMENT IN COMMERCE AND TRADE

This category includes jobs in the distribution of seeds and fertilizers and the work related to the marketing of agricultural produce. As stated in the first section of the paper, jobs created through an increased consumer demand consequent to the new prosperity are not included here.

There are blockwise differences in respect of jobs created through this source. As seen from Table V, Ballabgarh has 3.5 jobs per thousand acres under the new agriculture, and Fatehabad has 1.5. It is likely that total agricultural production rather than the area should determine such employment opportunities. But, unfortunately no data are available to help make such an estimate.

To work out a figure for employment in commercial activities consequent to the 'green revolution' a weighted average of the block figures has been taken, using area under HYV in each of the block as the weight. The figure arrived at is 1.8 persons per 1000 acres under HYV.

VI. EMPLOYMENT IN TRANSPORTATION

Like the employment in trade and commerce discussed in the earlier section there are blockwise differences in respect of employment in transport. In Nakodar 1.3 persons are needed for every extra 1000 acres of land brought under HYV, and in Fatehabad the demand equals 3.1. An overall figure, with area as the weight, is estimated at 1.9.

VII. SUPPORTING SERVICES

The supporting services included here are the jobs connected with electricity supply and the maintenance of tubewells, employment in petrol stations, financial institutions, extension work, and a little food processing like milling which is locally done. The total extra employment through such activities in Ballabgarh is of the order of 58, in Fatehabad 101, in Kapurthala 66 and in Nakodar 50. Dividing the total additional area under HYV, a figure of 1.6 persons for every one thousand acres is arrived at. This represents the demand for additional jobs through supporting services.

VIII. TOTAL TERTIARY SECTOR EMPLOYMENT

By adding additional employment in the four blocks due to all activities listed in this note, and dividing it by total additional area under HYV, we get an overall co-efficient of employment of 6.4 persons for every thousand acres.

IX. EVALUATION

The expercise carried out here gives a rough and ready tool to estimate the number of new jobs in the tertiary sector as a result of the 'green revolution'. The four blocks selected for study do not make a representative sample, interblock variations are wide, and a number of other situations which one easily visualizes are not covered.

The study deals with only the local impact of the 'green revolution', as it is reflected in a block and directly related

to agriculture-oriented activities. In all the new 'mandi' towns (market towns) that have grown up now, retail shops selling consumer goods, hotels, vendors, tailoring shops etc. have developed. The opinion in the mandi towns is that these activities have generated as many jobs as we have discussed.

Many traders believe that employment through commissioned agents and wholesalers' shops would depend upon the government's food grain purchase policy. The new 'mandis', as of date, are leaning too much on official patronage. It suggests that the norms given by this survey may not be valid in a changed situation.

Recently the government has decided to pass over the work of seeds and fertilizer distribution to private parties. There are differenting opinions about the employment potential of the new shops.

As observed, jobs connected with tractors do not develop in an area which is in the periphery of a big town or city.

A figure of 6.4 jobs per thousand acres under HYV should be of interest to policy makers in estimating how much of the negative effect of the 'green revolution' on employment is corrected by way of the tertiary employment opportunities.

STATISTICAL APPENDIX

TABLE I

SELECTED STATISTICS ABOUT BLOCKS

(Position as on 1st April 1970)

	Name of the Block			
	Ballabgarh	Fatehabad	Kapurthala	Nekodar*
Population (approx.)	150,000	90,000	100,000	100,000
Geographical Area	95,000 (acres)	213,506 (acres)	113,945 (acres)	72,000 (acres)
Cultivated Area (net) (acres)	55,365 (acres)	194,000 (acres)	67,375 (acres)	66,700 (acres)
Irrigated Area (net)	32,553 (acres)	75,000 (acres)	67,375 (acres)	40,000 (acres)
Total Number of Villages	87	57	154	144
Area Under HYV	13,652 (acres)	45,000 (acres)	67,000 (acres)	50,000 (acres)
Number of Tractors	55	102	181	185

* The state of statistics in the block after the reorganization of the district is such that only broad figures can be given.

TABLE II

ESTIMATED INCREASE IN AREA UNDER HYV AND
NUMBER OF TRACTORS
1966 TO 1970

Name of the Block	Increase in acreage under HYV	Increase in number of tractors
Ballabgarh	13,625	10
Fatehabad	45,000	91
Kapurthala	65,000	151
Nakodar	48,350	135
TOTAL:	172,002	387

TABLE III

ESTIMATED NUMBER OF NEW JOBS BY AVENUE, 1966-1970

Job Avenue	Name of the Block			
	Ballabgarh	Fatehabad	Kapurthala	Nakodar
1. Engineering: Workshops Spare parts cells	82*	36	20	50
2. Fertilizers and seed distribution outlets	37	25	80	70
3. Agricultural produce commission agents and wholesalers	8**	40	18	30
4. Transportation: Operators Palladars	38	130	92	50
5. Electric Supply: Tubewell repairs Wiremen	18	55	20	25
6. Petrol stations	3	6	6	6
7. Financial institutions	22	10	18	15
8. Extension work	15	-	2	4
9. Food processing	-	30	20	-
TOTAL:	223	332	276	250

* Some of the workshops undertook miscellaneous repairs and simple part manufactures of the general engineering nature.

**The data could not be collected in the course of the survey; here an estimate based on information from the other three blocks is given.

TABLE IV

A FEW CO-EFFICIENTS OF EMPLOYMENT THROUGH NEW AGRICULTURAL TECHNOLOGY

Sl.No.		Co-efficients
1.	Number of off-field whole-time jobs for each tractor (excluding manufacturing)	1.0
2.	Number of jobs in the transport sector per thousand acres brought under HYV	1.9
3.	Number of shop-keeping jobs (distribution of seeds and manures and disposal of additional produce) per thousand acres brought under HYV	1.8
4.	Number of supporting jobs including banking, extension work, electricians' work, at petrol stations and food processing, per 1000 acres under HYV	1.3
5.	Tertiary sector employment (direct) at the local level per thousand acres under HYV	6.4

TABLE V

BLOCK-WISE VARIATION IN THE CO-EFFICIENTS OF EMPLOYMENT

(Based on aggregative additional figures from the survey)

	Name of the Block			
	Ballabgarh	Fatehabad	Kapurthala	Nakodar
Total tertiary sector employment per thousand acres under HYV	16.2	7.4	4.1	5.2
Number of off-field jobs per tractor	8.2*	0.4	0.1	0.4
Number of shop-keeping jobs (fertilizer and seed distribution outlets, commission agents and wholesalers of agricultural produce) per thousand acres under HYV	3.5	1.5	1.5	2.1
Number of transportation jobs (operators plus palladars) per thousand acres under HYV	2.9	3.1	1.4	1.3
Supporting jobs (cols.5 to 9 in Table III) per thousand acre under HYV	14.2	1.5	0.7	1.0

* It was not possible to dismember employment by tractor workshops and other general engineering.

EMPLOYMENT IN IRANIAN INDUSTRY

Reza Razmara

I. Classification of Industries
II. Composition of Workshops
III. Composition of Workers
IV. Size of Industries
V. Industrial Activities
VI. Planning for the Future

I. CLASSIFICATION OF INDUSTRIES

Until the second quarter of the twentieth century, Iran had few modern Industries.

Apart from a large quantity of mineral oil, which was the major part of Iranian Industry and also the main source of the country's foreign exchange, the Iranian Industry was based mostly on handicrafts.

At the beginning of the industrialization program most of the investment was in food and textiles, but during later years, this was gradually extended to other sectors of industrial activity.

I. CLASSIFICATION OF INDUSTRIES

Iranian Industrial Statistics 1967-68 yearbook divides industry into 2 different group:

(i) Small workshops (Establishment)
(ii) Large workshops (Establishment)

A workshops is defined as a place where a physical or chemical transformation is applied to raw materials and semifinished or finished products are produced. The criteria for a small workshop is that the average number of workers during the year is under 10.

II. COMPOSITION OF WORKSHOPS

The composition of the workshops in the 1967-68

statistical yearbook, excluding the oil industry was as follows:

A- Total workshops in the country	451,621
B- Total workshops in the cities	160,723
a- large workshops	4,500
b- Small workshops	156,223

In group (A), representing the entire industrial activities of the country, the following information is of interest:

i) The total number of workers are 1,497,572,giving an average of 3.3 workers per workshop.

ii) The average annual wage paid to each worker of this group is about 156 U.S. dollars.

In group (B), accounting for 160,723 workshops located in the cities, with its breakdown of 4500 large workshops and 156,223 small workshops, the following information is available:

i) The total number of workers in 160,723 workshops (B) are 681,322, with an average of 4.2 workers per workshop. The total number of workers in the 4500 large workshops (B-a) are 222,436 with an average of 49.4 workers per workshop. The total number of workers in the 156,223 small workshops (B-b) are 458,891, with an average of 2.9 workers per workshop.

ii) Total wages paid to the group (B) were 253.4 M. dollers; average wage paid to each worker in group (B) was 372 dollars. Total wages paid to the group (B-a) were 168.1 M. dollars; average wage paid to each worker in group (B-a) was 756 dollars. Total wages paid to the group (B-b) were 85.3 M. dollars; average wage paid to each worker in group (B-b) was 186 dollars.

iii) New investment during the year in group (B) was 99.96 M. dollars. New investment during the year in group

(B-b) was 83.10 M. dollars. New investment during the year in group (B-b) was 16.86 M. dollars.

iv) The input value in group (B) was 1.512. 3 M. dollars; average input value in each workshop of group (B) was 9,409 dollars. The input value in group (B-a) was 1,047.2 M. dollars; average input value in each workshop of group (B-a) was 232,710 dollars. The input value in group (B-b) was 465.1 M. dollars; average input value in each workshop of group (B-b) was 2.977. dollars.

v) The output value in group (B) was 2,454 M.dollars; and average output value in each workshop of group (B) was 15,269. dollars. The output value in group (B-a) was 1,648.2 M. dollars; average output value in each workshop of group (B-a) was 366,256. dollars. The output value in group (B-b) was 805.9 M. dollars; average output value in each workshop of group (B-b) was 5.159 dollars.

vi) The total added value in group (B) was 941.8 M. dollars. The average added value in each workshop of group (B) was 5,860 dollars. The value added in group (B-a) was 601.0 M. dollars; the average value added in each workshop of group (B-a) was 133.773 dollars. The value added in group (B-b) was 340.8 M. dollars; and the average value added in each workshop of group (B-b) was 2182 M. dollars.

III. COMPOSITION OF WORKERS

Composition of workers in group (B) is as follows:

i) Total workers:

group (B)	681,327
(B-a)	222,436
(B-b)	458,891

ii) Owners and family members not receiving wages:

group (B)	211,652
(B-a)	7,637
(B-b)	204,015

iii) Workers receiving wages:

group (B)	469,675
(B-a)	214,799
(B-b)	254,876

Considering that the average national income in the year under study was 220 U.S. dollars, it implies that in group (B) individual income is 1.69 time, in group (B-a) 3.44 times, and in group (B-b) 0.85 times the average national income.

Another analysis of the wage earning workers may be made on the basis of productive and nonproductive workers. Conclusions obtained in this respect are as follows:

i) Productive workers:

group (B)	657,687
(B-a)	203,344
(B-b)	454,343

ii) Non productive workers

group (B)	23,640
(B-a)	19,092
(B-b)	4,548

iii) Average wage of productive workers:

group (B)	493 dollars
(B-a)	699 "
(B-b)	331 "

iv) Average wage of nonproductive workers:

group (B)	1,425 dollars
(B-a)	1,629 "
(B-b)	573 "

IV. SIZE OF INDUSTRIES

The proportion of large and small workshop as a percentage of the total number of workshops, on a national basis, is as follows:

Large workshops 1 per cent
Small workshops 99 per cent
Taking the same proportion for cities alone:
Large workshop 2.8 per cent.
Small workshops 97.2 per cent

As it was noted before, any workshop with over 10 workers has been considered as a large one. This definition being incomplete, only recently a new criteria has been established, taking into account other elements such as capital investment, yearly output and management of the plant.

The breakdown for the number of workshops classified according to the number is as follows:

Total No. of workshop in the entire country	451,621
Industries located within cities	160,728

a) With less than 10 workers	156,223	(average workers 3)
b) Between 10 and 50 workers	3,914	(average workers 17)
c) Between 50 and 1000 workers	570	(average workers 225)
d) Above 1000 workers	16	(average worker 1800)

V. INDUSTRIAL ACTIVITIES

Taking into account the 160,723 workshops located within cities the following classifications with respect to their Industrial activities may be made:

Type of Industries:

In this classification the number of different types of industries is as follows:

	Total	Percentage
1- Textile and wearing	43,036	26.78
2- Carpet and Flooring	28,220	17.56
3- Food Industries	21,924	13.64
4- Metal Industries	19,378	12.06
5- Wood and Furniture	15,538	9.67
6- Transport equipment	10,004	6.22
7- Mechinery and Electrical	5,681	3.53
8- Mineral Non Metallic	4,472	2.78

	Total	Percentage
9- Mineral Metallic	1,548	0.96
10- Leather and Fur	1,344	0.84
11- Rubber and Plastic	1,061	0.66
12- Others	8,517	5.30
	160,723	100.00

Number of Workers:

Industries classified by the number of workers is as follows:

	Total	Percentage
1- Carpet and Flooring	182,431	26.78
2- Food Industries	125,287	18.39
3- Textile and wearing	107,510	15.78
4- Metal Industries	58,556	8.59
5- Wood and Furniture	41,540	6.10
6- Mineral Non Metallic	38,891	5.71
7- Transportation Equipment	34,311	5.04
8- Electrical Equipment	16,184	2.38
9- Chemical Industries	9,753	1.43
10- Gas and Electrical Production	8,059	1.18
11- Mechinery	7,904	1.16
12- Others	50,901	7.46
	681,327	100.00

Added Value:

Added value being an indication of work done in the industry and its influence in the nation's economy is given below:

	Total(M.dollars)	Percentage
1- Food Industry	189.1	20.08
2- Carpet and Flooring	177.9	18.89
3- Textile and Weaving	91.4	9.70
4- Mineral, Non Metallic	79.1	8.40
5- Tobacco Industry	73.4	7.79
6- Transportation Industry	53.2	5.65
7- Metal Industry	52.4	5.56
8- Chemical Industry	39.8	4.23
9- Mechinery & Electrical Equipment	35.3	3.76

continued...

	Total(M.dollars)	Percentage
10- Wood and Furniture	29.0	3.08
11- Gas and Electric Production	28.6	3.04
12- Others	92.4	8.82
	941.8	100.00

VI. PLANNING FOR THE FUTURE

During the year 1967 Gross National Income had reached 6.65 billion U.S. dollars out of which 1.91 billion dollars, or 28.81 per cent of the total, was derived only from industrial activities. Of this income close to 50 per cent was from the oil industry, while 50 per cent was earned from the other industrial activities.

Iran's Fourth Development Plan, which was started by March 1968 and should end by March 1973, is a continuation of Iran's three previous Development Plans but is much larger in size and in its objectives. General objectives of Iran's Fourth Plan include :

i) An increase in the rate of economic growth and in national income by gradually increasing the relative importance of industry, raising the output of capital, using advanced techniques in all fields of activity and expanding scientific and applied research, especially for the solution of problems of economic growth.

ii) More equitable distribution of income by providing employment, expending social and welfare services to all and expanding local development and rehabilitation activity, especially in the rural areas.

iii) A decrease in the dependence on foreign countries in meeting basic requirements by increasing the rate of growth in the agricultural sector, so as to achieve the maximum supply of food-stuffs for the population and raw materials for domestic industry, as well as by supplying industrial goods for consumption.

iv) The diversification of export goods, expansion of

existing foreign markets and penetration of new foreign markets.

v) Improving the administrative services by the introduction of basic changes in the administrative system, and the extension of advanced managerical techniques to all ministries, public and private organizations, and strengthening the country's defence so that the government, while undertaking far-reaching social and economic reforms, is able to discharge the heavy responsibilities it has assumed.

The quantitative objectives for the economy during Iran's Fourth Plan are as follows:

Gross National Product should be increased by 57 per cent, representing an average annual increase of 9 per cent. This should raise Gross National Product from 6.92 billion U.S. dollars to 10.87 billion dollars by the end of the Fourth Plan. With an annual population growth of 2.6 per cent, per capita income will rise from $220 to $307 at the end of the Fourth Plan. The fixed investment required to achieve this target is estimated at a total 10.8 billion dollars during the Fourth plan, of which 9.91 billion dollars will be met from domestic sources and 0.89 billion dollars, or 8.2 per cent of the total, from external sources. The ratio of saving to Gross National Product will also increase from 18 to 25 per cent during the Plan period.

The export of goods and services, including oil, will increase from about 2.03 billion dollars to about 4.12 billion dollars, representing an annual increase of 15.6 per cent. Import of goods and services will increase from about 1.48 billion dollars to about 2.73 billion dollars at the end of the Fourth Plan, an average annual increase of 13.1 per cent. To achieve the above objectives of growth and investment, the increase in consumption must not exceed 10 per cent per year in the public sector and 6.7 per cent in the private sector during the Fourth Plan.

In the Fourth Plan the major emphasis is given to industrial investment because,

i) It has a higher rate of return than other sectors.

ii) Industrial growth will result in the extension of advanced production techniques and better management in other fields of economic activity.

iii) Unlike the agricultural sector, it is less affected by natural and climatic conditions.

iv) Industry is more capable of adapting the nature of its products to the requirements of the economy.

The total value of production of the industrial sector will be raised from 2.12 billion dollars to 4.33 billion dollars. This sector will achieve a total growth of 100 per cent during the Fourth Plan, or an average annual growth of 15 per cent. Production targets for the main branches of industry will as follows:

1- Food processing	104	per cent
2- Textile, clothing and leather	109	"
3- Metal	124	"
4- Mechanical, electrical & Automotive	223	"
5- Petro chemicals	891	"
6- Cellulose	131	"
7- Handicraft and carpet-weaving	76	"
8- Pharmaceuticals	602	"
Average growth for all industries	135	

The overall growth target for mining will be a 121 per cent increase, an average annual growth of about 17 per cent.

The production of the oil and gas industry will grow by 197 per cent, an average annual growth of 16.8 per cent. On the basis of the value of production in this sector the annual growth for all industries will be about 15 per cent.

Power production will rise from 4,500 million KWH to 12,000 million KWH at the end of the Fourth Plan, or an annual increase of 22 per cent. This target will be achieved by increasing total generating capacity to 1,621 megawatts. The per capita consumption will rise from 175 KWH to 400 KWH at the end of the Fourth Plan.

On the basis of the principle that a clear-cut manpower policy is indispensable for systematic and sustained economic growth,present manpower problems and those anticipated during the plan have been studied.

The country's population is expected to grow from 26.7 millions to 30.3 millions, out of which 16.9 millions will be within the age-group of 12-64, which is the working age in the country, and 7.96 million of them represent the active population. Persons employed in industry and mining will increase from 1,686 thousand to 2,103.

The attainment of the employment objectives of the Fourth Plan calls for the adoption of a number of measures of a general nature at the level of the major sectors of economic and social activity. This includes the following:

i) The full enforcement of the existing labour law which prohibits the employment of children under 12 years of age, even as apprentices.

ii) The establishment and enforcement of a minimum wage with regard to the cost of living, especially in cases where the low level of wages causes people to seek secondary employment to raise their earnings.

iii) The rapid extension of primary, secondary and higher education so as to diminish the potential pressure of the respective age groups on the labour market. During the Plan period the literacy rate in the 10-45 age group will increase from 35 per cent to 60 per cent. The rate will be much higher in industry than in agriculture.

iv) The introduction of compulsory apprenticeship contracts between employers and young apprentices in various branches of productive activity so as to enable industry to absorb more elementary-schools-leavers.

v) The extension of insurance and retirement benefits to the private sector so as to reduce the pressure of jobseekers in the public sector and to increase the turnover of employees in productive organizations in the private sector.

vi) The intorduction of courses of specialized vocational education at the secondary school level and above so as to enable more secondary school graduates to be absorbed into the private sector.

vii) The intorduction of vocational training schemes and the creation of employment opportunities for specific social groups such as prisoners, vagrants, and beggars detained in work camps, as well as the physically handi - capped people, by means of setting up workshops inside or outside these institutions.

viii) The regulation of the country's labour market by means of labour exchanges with a proper liaison between these exchanges; adult vocational training schemes; a social insurance department especially for the purpose of controlling local and seasonal unemployment.

ix) Preparation of short-term statistical series on changes in the labour-force, the labour market, wages and productivity to provide a statistical basis for the adoption of sound policies in these fields.

The distribution of newly employed personnel in the main branches of industry, by level of skill, during the Fourth Plan is as follows:

Branch of Industry	New employers		Productive employers		Engineers	
	No.	%	No.	%	No.	%
Manufacturing	297,000	71	242,000	71	1,700	58
Construction	94,000	23	75,000	22	800	27
Electricity	10,000	2	6,000	2	330	11
Mining	16,000	4	15,000	5	100	4
	417,000	100	338,000	100	2,930	100

continued....

Branch of Industry	Technicians		Skilled workers		Non Productive employees	
	No.	%	No.	%	No.	%
Manufacturing	6,800	48	117,000	68	55,000	70
Construction	4,400	35	48,000	28	19,000	24
Electricity	1,500	12	4,000	3	4,000	5
Mining	500	5	2,000	1	10,000	1
	12,450	100	171,000	100	79,000	100

The question of meeting the requirements of the country's industries for various levels of specialised personnel during the Fourth Plan is linked to several problems, the most important of which are summarized below:

i) In the field of engineering education, in view of the existing capacity of institutions of higher education in Iran, a shortage of engineers will be felt in certain fields unless effective measures are taken to expand these capacities. This shortage will be more severe in the field of electrical and mechanical engineering, which will have a greater demand than other fields. Four universities are providing these graduate engineers and measures have been taken to persuade a larger number of Iranian engineers residing abroad to return to Iran and take up specialized employment. An attempt must also be made to increase the number of subjects taught by our present engineering faculties, such as industrial design, metallurgy and electronics.

ii) Regarding technicians, the capabilities of our medium-level vocational schools for training the technicians needed for the plan are limited, and in some fields which are more developed in terms of quantity, they can barely meet half the requirement of the country. To overcome this shortage, both in term of quantity and quality, certain reforms have been introduced into the country's system of technical and vocational education including:

a- The speedy enforcement of the middle-level industrial vocational schools and coordination of vocational and technical training with actual needs of the labour market.

b- A revision of the duties, teaching methods and working hours of instructors at vocational and technical schools with a view to upgrading their employment status and increasing their qualitative as well as quantitative output.

c- The maximum diversification in the curricula of vocational schools, so as to ensure the supply of specialists required by the country's productive and administrative agencies.

d- The preparation and publication of textbooks in all field of vocational and technical training, for theorical and practical purposes.

iii) As regards skilled workers elementary vocational schools are responsible for the pre-employment training of skilled workers and specialists. The Ministry of Labour and Social Affairs also has certain vocational training centers to prepare vocational and technical instructors for the training. Only recently a new technical training act has been approved by the Iranian Legislature to extend vocational training with the cooperation of the private sector, and to establish new vocational training centers affiliated to large productive enterprises.

iv) Another subject of interest is the problem of training industrial managers, the greater part of whom will be needed by the manufacturing sector (87 per cent), and the remainder in the construction, electricity and mining sector (13 per cent). In this respect, the adoption of the following measures are essential:

a- It is essential that the training functions in the fields of management and industrial supervision, accounting, industrial warehousing, stock control marketing, quality control and productivity, should be expanded during the Fourth Plan. Not only large factories but also

medium-sized and small factories should benefit from the existing and the future facilities for such training services in the country.

b- Engineering and industrial training faculties should, and are, intorducing into their curricula such courses as the principles of industrial accounting, industrial management, production research, analysis of the distribution and sales net-works, production cost analysis, production engineering, linear programming, and modern methods of evaluating investment and appraising industrial projects.

Any account about Iranian industry and employment is incomplete if profit sharing already exercised is not mentioned.

Amongst the new measures which has been adopted during the recent years in Iran, a 12 point reform is of great importance in the raising of national living standards through a more equitable distribution of income and in the speeding-up of industrialization. The Fourth point of this reform is the incentives for increased labour productivity by means of profitsharing arrangements between industrial workers and management to the extent of 20 per cent of the net corporate earnings. By adoption of the new reform on profitsharing it is expected that Iranian industry may enter into a new phase. By increasing productivity a job on the bench gives as much dignity and pleasure as a job at a desk, along with the growing purchasing power and a more satisfactory way of life.

ECONOMIC POLICIES, INVESTMENT DECISIONS AND EMPLOYMENT IN TURKISH INDUSTRY

Dr. Ibrahim Ongut*

This paper examines the effect of certain economic policies on the choice of technology and employment within the context of the Turkish economy and in terms of a project in manufacturing industry. It is based on certain propositions assumed to be valid for the Turkish economy at its present state of development. These assumptions may, and I hope will be, questioned in this Conference. It will be proper to make them explicit at the outset.

At the center of the argument of this paper lies the proposition that in Turkey there are distortions in factor and product markets which encourage the use of relatively capital intensive technologies. Because of these distortions the economy cannot make full use of its human resources.

The basis distortion may reflect the inadequacy of the market mechanism in an underdeveloped country, with population pressure and rural underemployment, to produce a pattern of prices for factors of production which would reflect their relative scarcities and lead to an optimal use of resources in some (Paretian) sense. The argument is familiar and the model is the economy with unlimited supplies of labor where the productivity of labor at the margin is zero or negligible.

I must admit that I have not been very comfortable with the concept of disguised unemployment and not very impressed with attempts to measure it. There is, however, widespread belief, if not adequate statistical evidence, that some underemployment exists in the agricultural sector in Turkey and there is adequate visual evidence of idelness

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* The opinions and conclusions expressed herein are those of the author and not necessarily of the Industrial Development Bank of Turkey.

in the countryside as well as of casual employment in the cities to give support to this view. The State Planning Organization, however, is quite explicit on this question and the Second Five-Year Development Plan estimates disguised unemployment, defined as the ratio of the peak seasonal manpower requirement to manpower supply in agriculture at 9.9 per cent.

Further reading of the Plan shows that we also have unemployment in the non-agricultural sector, the estimates being 9.5 per cent for 1967 and 8.2 per cent for 1972. (Although the ratio declines, the number of unemployed increases in this period.) It should be mentioned at this point that recent years have seen an increasing exportation of manpower to foreign countries - more than 100,000 workers went abroad in 1969 - which has reduced the pressure of unemployment but also involved some loss of skilled workers for the Turkish economy.

Labor statistics in Turkey, in my opinion, are not adequate for a meaningful analysis of unemployment, open or disguised. I believe that there are parts of Turkey which fit the description of the economy with an unlimited supply of labor where the marginal product of the agricultural laborer is zero or not far from it. Although much of the underemployment in agriculture is seasonal in character there is a very rapid migration to urban centres where the supply of unskilled workers seems to be much in excess of the demand at the going wage, but where also skilled workers are in short supply. These statements certainly need verification. However, my experience with private firms in manufacturing industry lead me to believe that the supply curve of unskilled workers at existing wage levels is nearly horizontal.

Minimum wage legislation, compulsory social insurance,and particularly strong union pressure have lead to rapidly rising labor costs in the Turkish economy during the Plan period. Only last year the minimum

daily wage (Istanbul) was increased by 58 per cent, which resulted in a considerable rise in the total wage bill as well as in social insurance contributions; and unions put strong pressure for, and in most cases obtained, considerable margins above this minimum.

There is no wages and incomes policy in Turkey. Collective bargaining is generally on a plant rather than on an industry basis, with a number of unions competing in the same industry. Wage increases are not based on increases in labor productivity but depend on union power. And it is relatively easy to exercise that power in industries which produce for highly protected markets, where labor is able to share the benefits of protection.

The basic proposition of this paper then is that whatever divergence does exist between market prices and social opportunity costs of factors because of structural rigidities, immobility of factors and other sources of market imperfection, these divergences are aggravated by institutional arrangements in the economy as well as policies designed to accelerate private investment and economic growth.

One major source of distortion in the Turkish economy comes from maintaining an overvalued exchange rate. This is the result of a policy of industrialization based on import substitution, with a high level effective protection for domestic production through quantitative restrictions and import prohibitions which leads to increased dependence on raw material imports and unsatisfactory export performance, thus necessitating further restrictions to keep foreign payment under control. The pattern is not unfamiliar.

Whether this policy leads to a more rapid growth of the economy and creates more employment opportunities in the long run is beyond the scope of our present discussion. One can make a strong case for a systematic protection of domestic product markets on dynamic grounds. On the other hand,it may be argued that an indiscriminate protection of domestic production and the maintenance of

an overvalued exchange rate which encourages import substitution at the expense of exports may lead to a pattern of industrialization which would restrict employment opportunities in the long run. In other words, it might be more profitable to produce for the domestic market even if this leads to the establishment of industries which, by technological necessity, are capital intensive and less attractive to invest in export industries which are more likely to be labor intensive. I believe that foreign trade policies have produced a bias in this direction in the Turkish economy.

However, the bias I am concerned with here is that, given the commodity composition of production and trade, the maintenance of an overvalued exchange rate encourages the adoption of capital intensive methods of production by reducing the cost of (imported) capital goods relative to labor. In other words, capital is substituted for labor to the extent that this is technologically possible within given industries or specific operations. In addition to high wage costs, the overvalued exchange rate, I believe, is an important source of bias against the use of labor intensive methods.

A further source of bias against the use of labor intensive methods of production may be found in the tax and credit policies designed to encourage private investment. Various incentives are provided in Turkey for industrial investments which are in apparent conformity with the Plan targets. These take the form of tariff concessions on imported capital equipment or payment facilities for import duties on investment goods, income tax exemption for investment in fixed assets, accelerated depreciation allowance for industrial investments and concessionary credit terms for specified industries.

These incentives generally favour capital intensive methods of production by lowering the cost of capital, directly or indirectly, relative to labor costs. This is true for tariff concessions for imported equipment. Such

concessions, in addition to an overvalued currency, further reduce the effective import rates for capital goods and create a bias in favor of capital intensive technologies. I should add here that this incentive is used on a rather selective basis to encourage investments in specific industries or regions in Turkey.

A more widely used incentive is the payment facilities for import duties on capital goods. The importer may pay these duties in annual installments in five years. This is equivalent to a tax free medium-term term loan from the government. Again special credit terms are granted for specified industries through rediscounting facilities provided by the Central Bank, where the rate of interest to the ultimate borrowers is reduced from the 15-18 per cent regular commercial bank rate to about 11-12 per cent. The Industrial Development Bank of Turkey finances private industry with long-term loans which carry an interest rate of 8-9 per cent against a market rate of 13-15 per cent for bond issues of similar maturity.

Interest subsidies ought to be neutral between capital and labor intensive technologies. They would not create a systematic bias in favor of any one method of production, but only reduce financing costs, given the level of investment, which, including working capital, may be higher (or lower) in a labor (or capital) intensive process. However, to the extent that the availability of the interest subsidy is associated with and increases in relation to investment in fixed capital there would be a bias in favor of the capital intensive technologies, as in the case of the payment of import duties in installments, which in fact is an interest free loan. The same is true for loans from the Industrial Development Bank of Turkey which are available only for investment in fixed assets. In these cases, an enterprise which chooses a more capital intensive technology also takes advantage of a larger credit on concessionary terms.

On other incentive, income tax exemption for investments, also has a similar bias in that the exemption from tax is calculated on the basis of expenditures for fixed investment.

To what extent the above mentioned policies, and the distorting price system they create, produce a bias in favor of capital intensive technologies? How effective such distortions are in fact in influencing investment decisions in private industry? Would it be possible to quantify them, and if so what conclusions can be drawn from this?

I looked at several investment projects at the Industrial Development Bank of Turkey and discussed the problem with their promoters. The projects in question were mostly in import substituting industries. There was widespread and serious concern about the rising wage levels. However, among the projects I looked into there were not many instances where the investors had considered alternative methods and deliberately chosen a capital intensive technology. In the majority of cases it was explained that the technology was given and the technical possibility of substitution either did not exist or was very narrow. The applicants to the Bank for a loan in foreign exchange have to bring several offers for equipment to be purchased, which usually are from suppliers in different countries. Although the price of machinery changes from one supplier and country to another, the differences are not large and the processes are usually similar. This seems to suggest that in most cases the technology is imposed by the manufacturers of the equipment abroad. Yet it is also quite likely that because investors do not have an incentive to adopt labor intensive techniques, they do not explore the availability of less expensive, less modern and more labor absorbing equipment.

Where substitution was possible, in fact, as in the case of most anciliary operations, such as packaging and material handling, there was a marked tendency to replace labor with automatic machinery. Since such operations usually absorb a large amount of labor, their aggregate effect on total employment may be considerable.

In the few cases where there were options for using more or less capital intensive methods, a deliberate choice was made in favor of the more capital intensive method. One such case was a project for the manufacture of matches. The promoters of this project already owned a match factory which was financed by the Bank some fifteen years ago and it presently employed about 600 workers. It was a labor intensive project mainly because the boxes were produced with manual labor. The owners of this plant decided to set up another match factory approximately the same capacity, and the project was recently appraised in the Bank. This was a more capital intensive project where boxes were produced with automatic machinery. Investment in capital equipment was about 50 per cent more, but produced a considerable saving in labor costs. In fact, it employed only 106 workers for approximately the same output.

The promoters explained that it was the rise in labor costs, labor problems and difficulties in dealing with unions which influenced their decision in favor of the capital intensive method in the new project. In the existing enterprise they had seen the average cost of labor (including social insurance contributions) doubling between 1960 and 1969. They believed this trend would continue into the future,a belief which is widely shared in industry today where annual increases in the range of 10 per cent are considered normal.

I made a comparison of the two methods of production in terms of their private return to the investors under different sets of assumptions. These comparisons

are based on estimates of the present value of future costs and receipts from the projects, using a discount rate of 15 per cent, which corresponds to the average return in private industry today. Current market prices are used for the output and inputs. Wage costs are assumed to rise by 5 per cent annually except in the last two estimates where they are kept constant (x). Project I is the capital intensive new project and project II is the labor intensive (existing) plant. The results are shown in the Appendix.

The first estimate shows the profitability of the two projects under present conditions, including the tax incentives provided by the government as well as a development bank loan which carries a low rate of interest. The tax incentives in the case examined were: exemption from income tax, an amount equal to the investment in fixed assets from equity and the payment of import duties in equal installments in five years. The result of the first estimate shows that the promoters made the right decision in selecting the capital intensive project since it provided a present value over cost of TL 7.11 million, as compared to TL 6.14 million in the labor intensive project.

Would the picture change if no tax incentives were provided but the development bank loan was still available? In this case, the present value of the capital intensive project declines more than the other, but it is still the more profitable alternative.

Replacing the development bank loan (interest 9 per cent) with long-term borrowing from the market (interest 13 per cent) again does not change the ranking of the projects in terms of their profitability, although the

(x) Between 1963 and 1968 normal wages in manufacturing industry in Istanbul increased by 69 per cent and the cost of living index by 38 per cent. This means an annual increase of 4.5 per cent in real wages. Although statistical data are not available for 1969 it is believed that the rate of increase has accelerated during 1969 and 1970.

capital intensive project becomes relatively less attractive.

In the next estimate the official rate of exchange (TL 9 = $ 1) is replaced by a shadow rate (TL 15 = $ 1) used by the Industrial Development Bank of Turkey in its project appraisal. This raises the cost of (imported) capital equipment relative to labor and the profitability of both projects is reduced. The present value of the capital intensive project declines more than that of the labor intensive alternative and this adjustment changes the ranking of the projects. The labor intensive investment now becomes more profitable.

In the following estimate, I made the assumption that labor costs would remain constant at their present level. This might not be a realistic assumption under present conditions and it certainly does not conform to the expectations of investors. It is, however, a reasonable assumption, if the supply curve of unskilled labor at the going wage is infinitely elastic.

This assumption made a big difference and the labor intensive project became much more profitable. Its present value was now TL 9.75 million as compared to TL 5.38 million for the capital intensive project. This showed that the wage rate used in the evaluation of the project was the critical element in the choice of technology in the case examined.

In the final estimate which shows the combined effect of the adjusted exchange rate and the constant wage rate, the profit margin is naturally widened in favor of the labor intensive project.

What conclusions, if any, can we draw from this exercise? First, I should point out that looking at projects at the Industrial Development Bank of Turkey, the technological possibilities for factor substitution in manufacturing industry seemed rather limited. This, however, may be because investors did not have an incentive

to explore alternative (labor intensive) techniques. It is a fact that the range of factor substitution in manufacturing industry is narrow compared, for example, to construction. However, even within this limited range, the choice of technique may have significant consequences for employment. In the case examined, which is a relatively small investment, the selection of the capital intensive method in one part of the production process reduced employment opportunities by 500 workers. In fact, employment opportunities were reduced by more than this figure, since the foreign exchange saved on capital equipment (by the selection of the labor intensive technique) would have created employment opportunities elsewhere.

It was shown that wages, foreign trade policies, and tax and credit incentives designed to encourage investment may produce a bias in favor of capital intensive methods. These policies, which have implications for resource allocation and growth, cannot be judged by their effect on the choice of technology alone. This does not mean, however, that their implications for employment are unimportant.

The case we examined showed that the wage rate assumed in evaluating the projects was of critical importance. The profitability ranking of the project changed, only by assuming that real wages would remain constant during the life of the project. There was no need to introduce a "shadow" wage rate into our estimates. This would point to the need for a national wage policy in a country like Turkey which has an employment problem.

The Turkish planners are well aware of the problems I have touched upon in this paper. There are many passages in the Turkish Plans which would confirm the conclusions of this paper:

> "Efforts will be made to raise the lowest wage level to a point where the worker's subsistence and prosperity can be secured. The real increase

> in the lowest wage levels will be in proportion to the increase in productivity so that wages will impede progress and upset economic stability. With this understanding, the wage policy will be used as a tool to maintain an equitable income distribution and to increase the means of employment."*

Again:

> "Emphasis will be given to sectors which have high employment potential to raise the employment level and reduce unemployment. In addition, in all sectors high priority will be given to projects which offer many employment opportunities and which would save capital and create employment without increasing production costs. Research on the selection of technology will continue in order to attain the desired development in this area."**

Economic development may have conflicting aims and economic policies may have conflicting consequences especially where growth, employment and social justice are concerned. As shown in our case, policies designed to accelerate economic growth may well have restricting effects on employment. What is necessary is at least an awareness of the possible implications of these policies for the choice of technology and employment.

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* The Second Five-Year Development Plan, Ankara, 1967, p.150.

**The Second Five-Year Development Plan, Ankara, 1967, p.149.

A P P E N D I X

PRESENT VALUE OF THE PROJECTS

(Million TL)

	Project I (Capital intensive)	Project II (Labor intensive)
Including all incentives	7.11	6.14
a - Less income tax exemptions for investment expenditures	5.23	4.45
b - Less payment of custom duties by installment	4.91	4.37
c - Less interest subsidy	4.04	3.61
II - Excluding incentives and at shadow exchange rate ($1 = TL 15)	- 1.90	- 0.49
III - Excluding incentives and at constant wages	5.38	9.75
IV - III at shadow exchange rate	- 0.55	+ 5.63

FACTORS AFFECTING THE CHOICE OF TECHNOLOGY IN TURKEY AND IMPLICATIONS FOR LEVELS OF EMPLOYMENT

Dr. Demir Demirgil

I. Introduction
II. Factors Affecting the Choice of Techniques
III. Technological Dualism in Developing Countries
IV. Advances in Technology in the Developing Countries
V. Transfer of Technology
VI. Implications of the Growth of Income and Productivity for Employment.
VII. Outline, Conclusions and Recommendations

I. INTRODUCTION

Our paper investigates the factors affecting the choice of technology in developing countries, with special reference to Turkey; it considers the problems connected with the transfer of technology, discusses the problem of an appropriate technology for Turkey, attempts a critical evaluation of the choice of techniques contained in the Five Year Plans and, finally, evaluates the implications of the choice of techniques for levels of employment and recommends policy measures.

An attempt is also made to quantify the choice of techniques and relate them to the relative prices of capital and labor. It is based on the time series of value added, value of capital stock, price index for capital and the wage index for labor.

II. FACTORS AFFECTING THE CHOICE OF TECHNIQUES

Components of Technological Advance:

There is an increasing awareness in economic thought of the implications and importance of technological progress and its crucial role in the determination of production and income distribution. This is probably attributable to the evidence concerning the contribution to economic growth of variable technologies in addition to the traditional labor and capital factors. For some time technological advance was considered to be a factor which increased the

productivity of capital and labor; its contribution was estimated sometimes by the residual in the growth rate after allowance for the growth explained by other factors or by a time trend in productivity. In both cases technological change created a reduction in the real costs per unit of output or improvements in the quality and variety of final consumption goods as well as producers goods.

The components of technological progress include the productivity benefits of increased education, development of skills, improved health, innovations in design or in the product, economies of scale, removal of the restrictions on the mobility and economic effectiveness of resources and improvements in managerial efficiency. Technological change has another set of properties that are classified as neutral and non-neutral. In the case of neutral technical change labor and capital inputs are affected equally, in the case of non-neutral technical change the various factors are affected differently and technological change is either labor-saving or labor-using.

This long list of unidentified factors making up the residual reminds us of another category of investment to which a high priority must also be assigned, that is investment in human capital. It is increasingly recognized, that a large part of the growth in real national income is attributable to the increased education of the labor force and to the advance of technological and managerial knowledge which permitted more to be produced with a given quantity of resources. It can be argued on the same grounds that the acceleretion of development may be drastically reduced by a deficiency in the knowledge and skills of the people.

The implications of technological change for the development of the less developed countries are quite obvious. One is tempted to argue that if technological change has played an important role in the growth of the advanced countries, there is no reason why it should not do so in the case of the developing countries. It may indeed be true that changes in the technologly of production make higher rates of development possible. But we have to keep in mind the differences in social and economic conditions between the developed and less developed countries when studying

the way in which technological change can be realized. Technology has contributed to the growth of the advanced countries because of the presence of the preconditions for a high rate of technological change such as the availability of investible resources, the existence of economic conditions which directed these resources towards an accelerated development of the manufacturing industry,and the availability of skilled manpower and forms of economic organization that have made technological change readily acceptable and desirable to those who make decisions about production.

It would be a mistake to assume that the same conditions prevail at present in the developing countries: there is a large subsistence agriculture, and a large number of outmoded manufacturing units in the consumption goods industries. This implies that the contribution of technology to production can be fully realized only when action to change the socio-economic structure unfavorable to development is under way. In the short run, emphasis should be placed on the improvement of the existing technology of production and on the conservation and exploitation of domestic resources in a more rational way.

On the subject of relations between the technology of developed and underdeveloped countries, it is commonly argued that technological advances required in developing countries can be supplied, to a large extent,from technologies that are already developed in the advanced countries. The problem posed here will be developed in the third section of our paper. There is obviously no point in reinventing things that have been invented by other countries, and to the extent that technologies exist which are applicable to the production problems of the developing countries, ways have to be found to use them in these countries. There are of course some serious problems in making the transfer possible or at least in getting it to take place in terms in which it makes a real contribution to development. There are, however, certain distinct limits to the possible use of technology from abroad, which would apply even if really adequate mechanisms were set up to solve the problem of transfer. In fact,a transfer of technology cannot bring solutions to the following problems characteristic of developing nations.

1. To develop techniques which will employ productive factors in proportions equal to the proportions in which resources are available.

2. To develop techniques which will correspond to the market size and situations existing in developing countries.

3. To adapt the techniques to the local conditions of the underdeveloped countries.

4. To develop a precondition for the previous 3 points, a capacity for systematically identifying technological problems and possibilities in underdeveloped economies.

There is also the important question of the long term competitiveness of developing countries. It is evident that the competitive position of underdeveloped countries in the world market cannot improve as long as they are dependent on foreign technology rather than initiating their own. This does not mean that the developing countries have to be more advanced in all sectors and branches of production, but in the long run they have to develop a technological superiority in some.

It goes without saying that the absence of the preconditions just mentioned, and the lack of the ability to transfer technology/constitute the fundamental causes of the technological gap which exists between the advanced countries and the underdeveloped countries.

Choice of Technology in Developing Countries:

Engineers identify processes by the character of the physical and chemical transformations involved or the equipment which produces them. In more detail a technology consists of

1. product design
2. production techniques
3. industrial systems used to plan, organize and carry out a productive plan.

1. Product design involves the designing of a product for a particular set of environmental factors and conditions. Standards, building codes, rules and regulations, the composition of demand, the state of maintenance and other support facilities and services are factors affecting the product design.

2. Production techniques involve technical knowledge of industrial techniques.

3. Control systems. This comprises the controls and mechanisms required to plan and schedule the flow of materials and assure minimum standards in materials and parts. These systems include budgetary controls for planning and executing a production plan, production standards to formulate equipment requirements and schedule production, controls over the flow of materials and output, and quality control to assure minimum standards in purchased materials and parts, and programmed performance of end products.

Economists, on the other hand, do not need to know about physical and chemical processess and identify technologies by the amounts of production factors used and the associated outputs; the production function being simply a summary of all the physically efficient combinations of productive factors which are necessary for different output levels, for a given state of technical knowledge.

The Determinants of the Choice of Techniques at the Micro Level

Generally there is more than one way to produce any given output. As far as the engineer is concerned, each one of these combinations is equally good in producing this given output. But the economist, interested in keeping profits of the firm at a maximum and costs at a minimum, knows that only one of the combinations will give the least cost, just which one will depend of course, on the respective prices of the factors of production.

It is obvious that the firms, provided they are rational, will be inclined to change their input combinations because of changes in the relative prices of the

inputs, so as to use less of the inputs that have gone up proportionately more in price, i.e., they will substitute cheaper factors for expensive ones.

But even with constant factor prices optimal input proportions can change with the scale of output, as long as the production function has not the particular property of being homogenous of the first degree.

For the subject that we are investigating in this paper, it is desirable to distinguish these actions of firms in changing their input combinations because of changes in the relative prices of the inputs from those changes due to innovations and new techniques. Technical change substitutes for one set of factor inputs which is required for a particular output another set which is superior in the sense that it uses less of at least one factor.

At any moment different factor combinations might simultaneously be in use in producing a given commodity even if all firms are behaving optimally with respect to their choice of techniques. This is so because old combinations may rationally continue to be used as long as the variable or current costs of the old are less than the total costs of the new. For this reasons it will ordinarily take some period of time for a new process to become predominant.

As long as the advanced countries are characterized by relative capital abundance, they will take advantage of the substitution possibilities which may exist in order to use relatively less labor. The relatively capital intensive factor combinations resulting from input substitution are embodied into the design of standard equipment.

Costly Alternatives in the Choice of Techniques:

We have investigated above the choice of techniques made by entrepreneurs under the general principle of profit maximization. As long as a single factor receives the same returns in different uses and the price relationships among factors are in line with factor availabilities,

private and social choice of the techniques coincide. This is the case in advanced industrial countries which do not have continuous market imperfections and technical restraints.

But, for reasons which will be explained below, developing countries are characterized by structural disequilibrium at the factor level, and by technological restraints which force them either to buy the standard equipment of the developed countries or to pay higher prices for equipment especially designed for their own factor intensities. In either case the input substitutions which potentially exists in a particular technique do not become fully available to the less developed countries due to the lack of economies of scale in manufacturing equipment for them. Due to this disequilibrium, in the developing countries the private and social choice of techniques are very different.

In fact there are three sets of prices which lag behind the general price level, and another set (wages in the advanced sector) which is much higher than its scarcity value. These factors push individual firms to choose techniques which are more capital intensive than what they would choose if prices represented factor availabilities. The three sets of prices (which lag behind the general price level) are the exchange rate, interest rates and political prices.

In many developing countries, including Turkey, domestic currency tends to be over-valued. This policy, apart from hampering the development of the export industries and causing a haphazard development of the import-competing industries, has affected the choice of techniques of the individual firm by making the relatively capital intensive techniques more profitable.

This distortion is being accentuated by the interest rates being kept constant through government's monetary policy.

Also the elaborate social security legislation and government encouraged union movements produce wage rates in the non-agricultural sectors which are quite different

from those prevailing in the handicraft and agrarian sectors, and compel entrepreneurs in the advanced sectors to chose less labor intensive techniques than would have been the case with subsistence wages.

Lastly, whatever the actual characteristics of production and the degree of technical substitutability of factors, businessmen may believe that they face a production function with constant coefficients where no factor substitution is possible. Turkish businessmen, for example, may believe that the American way or the German way of producing is the best and only way and that this always involves high ratios of capital to labor. Plant engineers accustomed to emulating Western technology may not be sensitive to the range of choice actually available and may impose unnecessary technical contraints on entrepreneurs in under-developed countries. There is a psychological attraction in using capital intensive machinery because it is generally thought that only the automatic machinery used by the West represents modern industry.

Foreign exchange and credit availability may become a decisive factor for the purchase of machinery. The credit giving country may attach strings to its credit, forcing debtors to purchase its own products. The same applies also when the creditor is a firm rather than a government. Hence, if a foreigner supplier of fully automatic machinery can give credit on reasonable terms while a seller of less automated machinery cannot, the question of variable proportions between the factors of production cannot receive much attention.

Not all uses of modern techniques in underdeveloped countries are irrational, some of them might be the result of real limitations in the technological choices available. The nature of the productive process in many industries might be such that the technology rigidly sets constant factor proportions.

On the other hand, since the manufacturers of machinery and equipment are located in advanced industrial countries, the choice of technology is determined by the factor prices of the industrial countries where labor is

scarcer and more expensive than in underdeveloped countries, so that even if there are alternative processes all of them will be relatively capital intensive as they have been developed in the advanced industrial countries.

III. TECHNOLOGICAL DUALISM IN DEVELOPING COUNTRIES

In contrast to the modern sector where there is, or entrepreneurs believe there is, only a very limited degree of technical substitutability of factors, so that production is characterized by mixed technical coefficients and the production processes are relatively capital-intensive, the traditional rural sector has variable technical coefficients of production. The factor endowment is such that labor is the relatively more abundant factor, so that the techniques of production are labor intensive in the sense that relatively large amounts of labor and relatively small amounts of capital are used.

Keeping in mind the different production functions in the two sectors we can argue that technological dualism has intensified the problem of employment in developing countries. The size of the advanced sector is not big enough to enable this sector to create employment opportunities through its capital accumulation at a rate sufficient to obsorb the large labor force. Moreover, the production processes in the advanced sector are capital intensive and the technical coefficients are fixed. In the long run, technological progress does not ease the situation at all. For, in the modern sector technological progress favors more capital-intensive techniqies, so that it is all the more difficult to increase employment opportunities in this sector as investment and output expand.

IV. ADVANCES IN TECHNOLOGY AND THE DEVELOPING COUNTRIES

Continuing advances in technology in the developed countries gave rise to optimistic projections concerning the effects that these technological advances could have on production. A more careful investigation of this problem supports the idea that technological knowledge has thus far worked to the disadvantage of the underdeveloped countries.

The problem can be outlined according to two basic trends:

1. The deterioration of the international trading position of the developing countries.

2. The acceleration in the rate of population growth of the developing countries.

Both of these trends are, to a large extent, affected by advances in technology.

It can be argued that the demand for the traditional exports of underdeveloped countries has been decreasing very rapidly for the last half century. The low income-elasticities of these products and the protectionist policies of the developed countries can be considered to be partly responsible. But part of the reason is the increase in the production of these products, or of substitutes, in the developed countries themselves, mostly as a direct result of the technological advance in these countries.

The increase in population is mainly due to the rapid fall in mortality, which in turn is a direct result of the advances in medical technology that have made available protective medicine at relatively low prices.

Technology in the Five Year Plans:

The first and the second Five Year Plans both favor labor-intensive techniques. The statements in the FFYDP imply that with a rapidly increasing population, technological change, with its labor saving bias, is an undesirable factor for the solution of the unemployment problem. The SFYDP seems to follow the same bias. The main problem is one of utilizing labor in the agricultural sector, the intention being one of changing the technology and crop pattern in agriculture towards more labor intensive techniques, and developing handicrafts as an income-earning side-occupation.

A contradiction exists between the previous statement and the one which urges that in order to speed up

technological development in all branches of agriculture the use of modern inputs and means of production will be encouraged, the aim being to increase productivity in agriculture. Further, the Plan seems to accept the under-employment situation as it stands to devise measures that will take it into account in the effort to implement the development plans. Thus, although the basic trend on the world market is towards increasingly rapid technological change and higher productivity, the particular characteristics of the Turkish Economy would seem to have pushed the planners into checking the development of this trend in Turkey.

In another important passage of the Plan, however, the opposite view seems to have been taken, for it is said that choosing investments with a long-term prospective will call for a large-scale use of advanced technology and for a consideration of technical possibilities and progress.

In fact this contradiction in the analysis and in the general technological orientation of the economy would seem to be an expression of the actual contradiction that exists in the relationships between an underdeveloped country and the world market within which it must continue its development. While the basic forces operating on the world market result in a continuous pressure on all economies for the adoption of the most modern techniques available, the particular characteristics of the underdeveloped countries, with regard to both the initial levels of productivity and population growth, make it very difficult to accept this alternative; thus, the underdeveloped countries are left to oscillate between the demands of the world market and the pressures of their internal social structure.

Due to the basic problem arising from the interaction of two opposite pressures the measures proposed point, in general, in these two opposite directions. Thus, while the protection of small scale manufacturing and encouragement of the handicrafts industries appear to be examples of the concessions to the unemployment problem, the various changes envisaged in production techniques and efficiency are clearly directed to the solution of the problem created by the world market. It must be said,

however, that these and other similar changes appear to be marginal ones, totally within the framework of the existing production situation; the formulation of a coherent set of measures designed to deal with technological change on a large scale and in the long run, remains to be effected.

There is no need to stress the fact that the coordination of these measures with the measures relating to employment is entirely lacking. In short, the Plan's conception of technological change is a faithful reflection of the contradictory situation in which the underdeveloped economies of the world find themselves, and it is clear that the formulation of more consistent and closely related measures, derived consciously from an examination of the basic nature of the problem, is necessary.

The Choice of Technology :

Underdeveloped areas are characterized by structural disequilibrium at the factor level, identified as follows: Disequilibrium at the factor level may arise either because a single factor receives different returns in different uses or because the price relationship between the factors is out of line with factor availabilities.

This suggestion has been the starting point for two explanations of unemployment and underemployment in underdeveloped areas. The first assumes that the available technology would permit full use of the working force at some set of relative prices and finds the source of unemployment in various types of imperfections in the price system, such as trade-union pressures, immobility of labor, government social legislation, or other factor market imperfections which maintain the wage rate at a higher level rather than allow it to fall to a level which will clear the labor market. At the higher wage rate the demand for labor will not absorb all the labor available and it could be said that the wage rate does not represent factor endowments. At this wage rate there is an artificially high ratio of the price of labor to the price of capital. This ratio becomes higher with the degree of overvaluation

of the Turkish currency and with interest rates kept low through government interference. If we assume that factor substitution is in fact possible, a structure of production with a higher capital-labor ratio than otherwise may result.

Thus, as output increased, increased employment would require the use of more capital than would be needed if the structure of production were adjusted to a lower labor-capital price-ratio, unless the substitution effects were offset by increasing return to scale. In a country in which capital in scarce and unemployment considerable, the attempts to achieve more employment by the use of relatively capital-intensive investment would be more likely to lead to inflation and balance of payments difficulties, than if more labor intensive techniques were used.

The development of social policy in economically underdeveloped areas frequently proceeds more rapidly than economic growth. Elaborate social security legislation and government encouraged union movements are often found in densely populated, low per capita income countries which are just on the threshold of economic advancement. There is little or no scope for such devices for raising wages except in the relatively more advanced and well organized sectors. Therefore, new industrial projects may face the prospect of wage rates quite different from those prevailing in the handicraft and agrarian sectors and may thus be compelled to use different factor proportions.

Secondly we might investigate the effects of changes in the composition of demand for goods and factors due to such influences as changes in the methods of production, or in the directions and levels of demand as a result of changes in tastes or in foreign competition. In this second case, as the level of aggregate effective demand rises, goods will be demanded in different proportions than formerly and the location and magnitude of the demand for factors of production will shift. If labor is not mobile, or if it takes considerable wage increases to shift it, then factor disequilibrium would developed in

certain industries. An increase in the level of effective demand would push other industries to the limits of their capacity relatively quickly. Money wages and prices would begin to rise, not uniformly but in the bottleneck sectors. New investments in these sections would tend to increase still further the substitution of capital for labor. The balance of payments, under the pressure of the growing domestic inflationary tendencies and increased demand for capital imports, would tend also to develop deficits at an earlier stage in the growth of national income. All this could aggravate the factor disequilibrium previously discussed.

Capital - Saving Analysis:

The problem of the choice of technology is one that has been treated in different ways by two different schools of thought. The first approach is mainly based on the analysis of what can be called the "capital - saving" school, showing that the possibilities of developments are finally limited by the size of the market. In physical terms, this derives from the low productivity of labor with scarce capital (probably with considerable disguised unemployment). Thus, if development is desired this circle must be broken, and it must be broken through the introduction of capital-saving techniques, which will utilize the cheap manpower ..... with a similar analysis the idea of appropriate technologies for the underdeveloped countries has been developed. These techniques, though not necessarily the most primitive, will take account of the excess supply of manpower.

This analysis, or rather the conclusions drawn from it, are objectionable for a number of reasons:

1. At the purely logical level, if the final cause of the plight of the underdeveloped countries is low productivity based on low capital intensity, it is a mistake to claim that this situation can be changed by capital-saving techniques; indeed this would only tend to perpetuate the existing production conditions, which have been rightly described as those of low capital intensity, i.e., using capital-saving techniques.

2. The stipulation about "cheap manpower" also leads to a theoretical impasse, for the cheapness of the manpower is not a given in itself but only a symptom of the low productivity in economic activity and of the

degree of underdevelopment in general. Pretending to put an end to underdevelopment by basing the development strategy on a condition (i.e. low wages) which is nothing other than a result of underdevelopment, is sheer nonsense.

3. The logical and theoretical fallacy of the policy is further confirmed by a consideration of the practical results bound to follow it; with the capital-saving techniques envisaged, not only will there be no change in the situation, since the value added and the marginal saving ratio can only be slightly increased if at all, but the situation will tend to worsen as the influence of capital intensive technologies on the international market increases; the economy will always be following the developed countries from behind. The experience of the last fifteen years has shown that even with a conclusive development effort, the situation of many underdeveloped countries has been worsening not only in relative but also in absolute terms.

The choice of techniques has far-reaching repercussions on other important variables of the growth process. Labor-intensive and capital-saving techniques might not be compatible with further capital formation. In fact, for most underdeveloped countries in the process of industrialization, social legislation in favor of the worker's will not allow for ceilings to be placed on wage rates which at the beginning of the industrialization process are at subsistence levels. Thus, any increases in productivity will take the form of higher wages in the case of labor-intensive techniques and the total wage bill will be larger. This process is considered undesirable from the view point of capital formation because it assumes that the higher labor earnings will go into consumption rather than into savings, while if they were left for capitalists who have a much higher propensity to save and invest, it would have increased capital formation.

On theoreitcal grounds this model has a certain validity. But if we try to make it move realistic we might find that the validity of the model is considerably

reduced. In countries like Turkey where tax evasion is high the increase in profits might not produce any incremental tax revenue, or if it produces it, it might produce very little, while the increase in labor earnings will be reported in full. We can conclude that the validity of the assertion that labor-intensive techniques limit future capital formation is very much diminished; full reporting of wages for tax purposes and considerable tax evasion on profits increases public capital formation in the first case reduces it in the second. But it will not be clear which one of these two alternatives is more conducive to future capital formation if the marginal propensities to save are not known. For developed countries non-wage incomes earners show a much higher marginal propensity to save than the wage earners. But this does not seem to be so true for underdeveloped countries where conspicuous consumption and residential construction increases the marginal propensity to consume of the non-wage earners.

Another objection formulated against labor intensity is the cost of training and housing of additional labor. But even this disadvantage should not be taken so seriously as this cost is contributing to the formation and education of the emerging labor force.

The Most Advanced Techniques Analysis:

Various authors have noticed the fallacy of the arguments for capital-saving techniques and emphasized the fact that the low productivity of capital-saving techniques will tend to perpetuate the existing conditions, rather than to change them. Unless the jump made by the underdeveloped countries is a large one, putting them on the most advanced technological level in at least the important branches, the development effort will not be viable but will degenerate into further underdevelopment.

1. Since the trend on the world market is towards greater and greater productivity per worker due to continuous technological change, and since economic development implies the integration of the underdeveloped economy into the world market at a different level of productivity than the one it posseses at present, it is obvious that the long-term economic development effort

of an underdeveloped country has to be oriented towards the adoption of capital-intensive production methods and of the most modern techniques available in the market.

2. It is equally clear that the most efficient way of developing lies in the attainment of the largest possible increase in the rate of capital accumulation, and consequently in the adoption of the techniques which will yield the largest investible funds possible.

(i) The elimination of the balance of payments deficit of the economy should be considered only as a target for the very long run when the basic development problems have been solved and when, having attained competitive rates of productivity and a comparative advantage in certain production areas, the underdeveloped country is able to close the deficit through normal economic activity, rather than with extraordinary stringency measures. In this context the provision of long term low interest funds for the establishment of highly productive capital goods industries in the underdeveloped countries becomes a crucial element of international aid policy.

(ii) Even with increased aid, and more so without it, the adoption of the most modern methods of production available will continue to be limited by three factors.

- the unemployment situation
- the wage levels
- the capacity of the economy to absorb highly productive capital goods, which is identical to its capacity for the creation of technically skilled manpower, administrative elements etc., needed to conceive, organize and maintain production at a high level of efficiency.

It is clear, given the initial constraints of the underdeveloped economy and the short-term exigencies of economic development as formulated by the unemployment constraints accepted in the Turkish Plan, that the adoption of modern techniques cannot continue unchecked and that the employment situation has to be taken into account.

Thus it will certainly be necessary, in the short and medium terms, to tolerate the existence of relatively unproductive techniques and areas of production due to the fact that they absorb a certain amount of manpower which would otherwise be unemployed. At some points it may be necessary to expand such areas, to absorb the additional unemployed on the market. However, this should be explicitly recognized as a cost imposed by social considerations, and its limits should be very clearly determined. It must always remain clear, however, that in no way can the measures related to these employment areas or techniques be considered to be the definite solution to the unemployment problem. Rather they are compulsory deformations of the production pattern on which a tight check should be maintained, and which should be attenuated and abolished at a rythme parallel to the development of the overall production possibilities of the economy.

On the other hand, as far as the wage levels are concerned, it is clear that it may be possible in some areas to adopt patterns and techniques of production that are not the optimum in the sense of the world market, but appropriate in the sense of techniques leading to the maximum yield on investible funds. To the extent that such areas exist it may be feasible to delay the introduction of the most modern techniques until the situation has further evolved.

However, it is quite unlikely that many such areas can be found, for productivity differentials between different techniques are generally much greater than wage differentials. In a manner similar to that used in "unemployment areas" above, extreme care should be taken to control the use of these techniques and to reduce the flow of investible funds into these areas parallel to the diminution of wage differentials. It would be futile to view these technologies as the basic solution to the development problem, for in the long run, development aims at abolishing the very conditions that these techniques are based upon.

V. TRANSFER OF TECHNOLOGY

Let us assume for a moment the desirability of the transfer of technology to the developing countries. We

may start by describing the nature of what is being transferred. The advanced technology to be transferred to the developing countries is a complex composed of the design of the product, the production techniques and the industrial systems used to plan, organize and carry out a production plan.

The problem is to find out what determines the capacity of developing countries for incorporating the advanced technology into their own economic activity. The capacity to assimilate the advanced technology might be limited for a very simple reason. Funds to reorganize operations might not be available, or even if they are available the foreign exchange required for the transfer to take place may be lacking. Also the advanced technologies may not be usable in developing countries and might require alternations, because these techniques have been developed in social and physical environments very different from those of underdeveloped countries. It has to be first determined which parts of the advanced techniques can be transferred directly, and which of them need to be adapted to the economic and social conditions of the developing countries. But in order to be able to determine this there must be competent scientists and engineers who can understand both the basis of the advanced technology and the circumstances of the underdeveloped economies.

The difficulties involved in such transfers will be greater

1. The greater is the complexity of the components and parts of the technology to be transferred.

2. The greater is the gap between the firm making the transfer and the firm on the receiving side.

3. The greater is the gap between the industry of the advanced economy and the industry of the developing economy.

4. The greater are the balance of payments problems of the developing economy as a result of which there are limited possibilities of importing capital goods in order to offset domestic deficiencies.

5. The greater are the difference in the social environment where operations are being conducted.

Let us now look at the details of the transfer operations and try to apply these five points.

The Design of the Product:

Products are being designed for a particular set of environmental factors and conditions. In cases where the building codes, standards, rules and regulations, of the developing country are different, certain features of the product need to be changed to adapt to these conditions. Moreover, in underdeveloped countries the scale and sophistication of the advanced technology must be geared down to lower levels of demand and to the deficient maintenance and other support facilities and services.

The Techniques of Production:

The transmission of technical knowledge on industrial techniques requires engineers and technical personnel of high quality.

Control Systems related to Advanced Technology:

Modern production systems require controls and mechanisms to plan the flow of materials and assure minimum standards in materials and parts. The quality of the engineering and managerial personnel running these production systems determines, to a large extent, the efficiency of the transfer of technology. We can now proceed to the investigation of how the transfer can take place and of the problems involved.

Problems of Scale and Sophistication:

One of the main difficulties is that technologies developed in industrialised societies are generally of a scale and sophistication unsuited to the production conditions and the size of the market of the developing economies. Efficient techniques can be inefficient when transplanted to developing countries, due to higher costs and/or inferior products. These countries lack the necessary manual and managerial skills and also certain

kinds of materials. When materials are available they are generally of an inferior quality. Moreover, the design of the product is different in the developing economy due to the different social, economic and physical environment and different consumer tastes.

In advanced economies, with the growth of incomes and markets and the improvement in transportation, the scale of operations in production has been expanded to take advantage of economies of scale. There is a high degree of integration between different firms and different industries. Individual firms have to rely for hundreds of parts, finished and semi-finished, on hundreds of producers. The alternative would be to produce all these parts in a single firm but at a higher cost due to the smaller volume.

In developing economies consumer demand is deficient and markets small in many instances. On the other hand the ability of specialized producers to produce standard parts is limited, and balance of payments difficulties do not allow for imports of parts to supplement the domestic production. Turkey has relied heavily upon import substitution in the first and second Five Year Plans. Import substitution policies have provided protection for the domestically produced goods, but they have also intensified supply difficulties. This policy has encouraged relatively small scale, high costs production for the narrow domestic market protected from foreign competition. The increase in the number of such small, inefficient factories has created excessive balance of payments difficulties, and resulted in a waste of scarce resources especially technical and managerial personnel. As a result of these circumstances manufacturing costs are expected to increase to levels very much exceeding those in industrially advanced countries.

Economic planning in Turkey has been preoccupied with physical balances rather than comparative costs. This tendency has given support to the high cost industries. Already a misallocation of resources exists due to price distortions and the allocation systems for foreign exchange

and for capital equipment and scarce materials. As long as a truly competitive system is not created there cannot be specialization in industries based upon comparative advantage or the choice of techniques which economize on scarce factors. For economic efficiency to be improved the very general import substitution should be abandoned in favor of comparative advantage applied in a dynamic frame of reference, which will enable specialization in commodities that can be easily exported.

The Role of International Firms in the Adaptation of Advanced Technology to Underdeveloped Countries:

At first sight international firms with experience in countries outside their own seem to be the right agencies for the transfer and adaptation of technology. They are efficient, large and have access to the commodity and factor markets in many countries. But the historical performance of international firms in underdeveloped countries leaves much to be desired.

The volume of investment brought by international firms is small and its impact on the economies of the underdeveloped countries very limited. Moreover, the modern techniques brought by them were restricted to certain sectors and were far from spreading to the rest of the economy of the underdeveloped country. The techniques transferred from the developed countries were highly specialized and sophisticated, but due to the differences in physical, social and economic environment they could not be equally efficient . International firms generally prefer to import raw materials, semi-finished goods and finished parts of the goods they produce rather than try to find ways of using domestic resources, probably because it is easier, because they can charge higher prices for what they bring, and because they operate in imperfectly competitive markets.

In short, we can sum up by saying that international firms do not have much to offer to the developing countries, as they charge very high prices for whatever they are contributing.

Basically the problem is one of the adaptation of technology to the underdeveloped country, through international firms or without their intermediation. The developing countries do not need the technology used in the advanced countries which is generally not suited to their factor endowments; what they need is the ability to discover and develop techniques suitable to their resources, and the international firms do not seem to be of much use in this respect.

VI. IMPLICATIONS OF THE GROWTH OF INCOME AND PRODUCTIVITY FOR EMPLOYMENT

As has been explained in another section of this paper Turkey has made three attempts towards quick industrialization in the 48 years of her life as a new nation; the first one in the 1930's, mainly through public initiative, the second one in the 1950's, through public and private initiative, and the third in the 1960's that we might call planned industrialization in a mixed economy.

The third attempt is too recent to afford a long run analysis but the first two attempts can be profitably analyzed from the view point of the main theme of our paper. As industrialization proceeds, bringing with it the known characteristics of labor legislation, minimum wages, collective bargaining and a scarcity of skilled labor, economic theory points to an inverse relationship between the output capital ratio and the level of economic development.

Assuming constant returns to scale and the full use of capacity as industrialization proceeds, the capital/output ratio is expected to rise, or the output/capital ratio to decrease, in every sector.

Data used in Computing O/K and O/L:

Our study is based on Economic Accounts of non-financial Public Enterprises 1939-1963, a statistical Study of Public Enterprises in Turkey sponsored jointly by the State Institute of Statistics, Ankara, Turkey, and the Yale University Economic Growth Center, New Haven,

Connecticut. The date weredrawn mainly from reports submitted by enterprises to the High Control Board, the government agency responsible for auditing most public enterprise accounts. These reports were first published on a regular basis beginning in 1939, although many public enterprises began their operations much earlier. Economic accounts for the period before 1939 can be constructed by using information obtained from supplementary sources, but these sources do not provide sufficient date to establish consistent and complete accounts.

Classification of Non-Financial Public Enterprises in Manufacturing 1939 - 1963

1. Heavy Industry
   (1) Machine and Chemical Industries (Makine ve Kimya Endüstrisi Kurumu)
   (2) Iron and Steel Works (From 1939 until 1954 a Sümerbank establishment (Karabük); afterwards the steel operations of Türkiye Demir ve Çelik İşletmeleri)
   (3) Istanbul Oil Refinery (İstanbul Petrol Rafinerisi A.S.)

2. Food Processing
   (1) Sugar Factories (Türkiye Şeker Fabrikalari A.Ş.)
   (2) Ordu Soyabean Oil Industry (Ordu Soya Sanayii A.Ş.)
   (3) Aksaray Flour Industry (Aksaray Azmi Milli T.A.Ş.)
   (4) South East Olive Oil and Olive Products (Güneydoğu Sanayii ve Ticaret A.Ş.)
   (5) Ülfet Food and Soap Industry Ülfet Gida ve Subun Sanayii A.Ş.)
   (6) Feeds and Fodder Industry (Yem Sanayii T.A.Ş.)

3. Total Textiles

a. Textiles, 1939-1948
   (1) Combined Wool, Cotton and Artificial Fiber Textile Plants
   (2) Malatya Cloth and Thread Factory (Malatya Bez ve Iplik Fabrikasi)

(3) Agricultural Bank Cotton Textile Organization (Ziraat Bankasi Adana Pamuklu Müessesesi)

b. Cotton Textiles, 1949-1963
(1) Sümerbank Ereğli Pamuklu Dokuma Sanayii Müessesesi
(2) Sümerbank Bakirköy Pamuklu Dokuma Sanayii Müessesesi
(3) Sumerbank Kayseri, Erzincan, Adana, and Adana Circir Pamuklu Dokuma Sanayii Müessesesi
(4) Sümerbank Malatya Pamuklu Dokuma Müessesesi
(5) Sümerbank Nazilli, İzmir, Denizli Basma Sanayii Müessesesi
(6) Adiyaman Pamuklu Dokuma Sanayii T.A.Ş.
(7) Antalya Pamuklu Dokuma Sanayii T.A.Ş.
(8) Bergama Pamuk İplik ve Dokuma Sanayii T.A.Ş.
(9) Eskişehir Basma Sanayii T.A.Ş.
(10) Karaman İplik ve Pamuklu Mensucat T.A.Ş.
(11) Manisa Pamuklu Mensucat A.Ş.
(12) Maraş Tekstil Fabrikasi
(13) Nevşehir Pamuklu Dokuma Sanayii T.A.Ş.

c. Wool and other textiles, 1949-1963
(1) Sümerbank Defterdar, Hereke, Bunyan İsparta and Diyarbakir wool textile factories
(2) Sümerbank Bursa Merinos Wool Textile factory
(3) Sümerbank Taşköprü Hemp Industry (Sümerbank Taşköprü Kendir Sanayii Müessesesi)
(4) Sümerbank Gemlik Artificial Fiber and Viscose Industry (Sümerbank Gemlik Sun'i İpek ve Viskoz Mamulleri Sanayii Müessesesi)

4. Other Manufacturing

(1) Sümerbank Paper and Cellulose Industries (Sümerbank Selüloz Sanayii Müessesesi (1938-1954) and Türkiye Selüloz ve Kâğit Fab. İşlet. (1955-1963)
(2) Içel Cellulose Industry (İçel Selüloz Sanayii)
(3) Sümerbank Leather ve Shoe Industry (Sümerbank Deri ve Kundura Sanayii Muessesesi)

(4) Sumerbank Cement Factory (Sivas) (Sumerbank Cimento Sanayii (Sivas)

(5) Ankara Cement Factory
(Ankara Çimento Sanayii Ltd. Sti.)
(6) Turkish Cement Corporation (Sonsolidated)
(Türkiye Çimento Sanayii T.A.S.) (Consolide)
(7) Sümerbank Filyos Fire Bricks Industry
(Sümerbank Filyos Ateş Tuğlasi Müessesesi)
(8) Sümerbank Yildiz Porcelain Industry
(Sümerbank Yildiz Porselen Müessesesi)
(9) Porcelain and China Industry
(Porselen ve Çini Fabrikalari Ltd.Şti.)
(10) Sümerbank Ceramics Industry
(Sümerbank Seramik Sanayii Müessesesi)
(11) Turkish Agricultural Equipment and Machinery Association (Türkiye Zirai Donatim Kurumu Ziraat Alet ve Makinalari Müessesesi)
(12) Machinery Spare Parts Joint Stock Company
(Makine Yedek Parçalari T.A.Ş.)
(13) Nitrogen Industry Joint Stock Company
(Azot Sanayii T.A.Ş.)
(14) Salihli Acorn and Acorn Oil Industry
(Salihli Palamut ve Valeks Sanayii A.Ş.)
(15) Çanakkale Acorn and Acorn Oil Industry
(Çanakkale Palamut ve Valeks Sanayii A.Ş.)
(16) Wood Products Joint Stock Company
(Sun'i Tahta Sanayii T.A.Ş.)
(17) Rubber Industry Joint Stock Company
(Kauçuk Sanayii T.A.Ş.)
(18) Güneş Printing Joint Stock Company
(Güneş Mathaacilik T.A.Ş.)

Data Used:

Value added is the sum of 6 items
Wages and salaries
Interest and commissions
Indirect taxes
Subsidies
Profits
Depreciation Allowances (recorded as a negative number)

To check the accuracy of value added calculated as the sum of factor payments it is also calculated as the difference between the value of production and the value of goods used in production.

Value added at constant prices has been deflated, firm by firm, by the physical quantity given side by side with the production figures. Nominal Capital Stock has been deflated by using one index covering 1948 to 1963 prepared by the SPO; for the period 1939 to 1948 an index prepared by the Committee for Reorganization of State Economic Enterprises has been used. Wages for the different Sectors as well as for Manufacturing are obtained by dividing Total Wages for each sector by the average number of persons employed in it.

Empirical Results: O/K regressed on O/L

The conclusion to be derived from the data on the output/capital ratio on the one hand, and output per laborer on the other, is that the data fail to support the hypothesis that there is a negative association between the two variables. On the contrary, the opposite of this hypothesis seems to emerge from all the cases except one where the association is negative but the R^2 is so small that, when adjusted for the degrees of freedom (N), the result is positive.

The results are summarized by means of a simple regression analysis using the equation of the form:

$$\log Y = a + b \log X$$

where Y denotes the output/capital ratio and X is the output per laborer in manufacturing.

The regression coefficients based on N = 23 and covering the period 1939-1963 are given in Table 1, and those for N = 13 (1949-1963) in Table 2. It can be seen from table 1 that none of the industrial groups has the correct sign. "Other industries", occupying block number 5, are not significant. We can infer from this that the regression analysi reveals that in none of the five cases, (the first one be g the aggregation under Manufacturing of the four industrial groups) can the hypothesis be supported. On the other hand, we find that all cases substantiate the reverse argument that there is a positive relationship between the output/capital ratio and the output/labor ratio.

Turning to table 2 where O/K is again regressed on O/L but for a period shorter than the one shown in table 1. None of the five groups have the correct sign. On the contrary they support the hypothesis that the output/capital ratio is positively associated with the output/labor ratio in all the five groups, two are significant at the level of 0.01, two are significant at the level of 0.05, and one at the level of 0.30.

In short, the original hypothesis cannot be confirmed in any of the five groups in the two periods. Instead we find that the opposite hypothesis is more plausible.

Another possible source of bias is the effect of any one of the components of technological progress such as increased education, development of skills, improved health, innovations of the design or of the product, removal of the restrictions on the mobility and economic effectiveness of resources and improvements in managerial efficiency.

Finally, cyclical changes in the use of capacity might have affected the results of the regression analysis. The most obvious phases of these cyclical changes seem to be related to political events: the downturn in 1949 and 1950 can be identified with the change of the party in power, the upturn in 1959 and 1960 with the stabilization policy started on August 4, 1958, and the rapid downturn in 1961 and 1962 with the after effects of the military coup d'etat of May 27, 1960.

TABLE 1

OUTPUT/CAPITAL RATIO REGRESSED ON OUTPUT PER WORKER
(1939 - 1963 PUBLIC SECTOR)

$\log (O/K) = a + b \log (O/L)$

Industrial Group	b	Sb	$\bar{R}^2$	N
1. Manufacturing	0.7024	6.1052	0.6018	23
2. Heavy Industry	1.1497	13.4106	0.8860	23
3. Food	0.7931	11.3899	0.8428	23
4. Textiles	0.6466	2.8138	0.2237	23

TABLE 2

OUTPUT/CAPITAL RATIO REGRESSED ON OUTPUT
(1949 - 1963 PUBLIC SECTOR)

$\log (O/K) = a + b \log(O/L)$

Industrial Group	b	Sb	$\bar{R}^2$	N
1. Manufacturing	0.9957	2.2900	0.2326	13
2. Heavy Industry	1.2513	3.1182	0.3839	13
3. Food	0.4856	3.9123	0.5054	13
4. Textiles	0.3818	1.2054	0.0036	13
5. Others	0.4103	1.9645	0.1695	13

TABLE 3

OUTPUT/CAPITAL RATIO REGRESSED ON OUTPUT PER WORKER
(1939 - 1963 PUBLIC SECTOR)

$(O/K) = a + b(O/L)$

Industrial Group	b	Sb	$\bar{R}^2$	N
1. Manufacturing	14.2627	5.9574	0.5896	23
2. Heavy Industry	11.4045	6.8551	0.6666	23
3. Food	12.7981	9.5635	0.7903	23
4. Textiles	25.9445	2.6528	0.2010	23

TABLE 4

OUTPUT/CAPITAL RATIO REGRESSED ON OUTPUT PER WORKER
(1949 - 1963 PUBLIC SECTOR)

$(O/K) = a + b(O/L)$

Industrial Group	b	Sb	$\bar{R}^2$	N
1. Manufacturing	9.2692	2.1313	0.2019	13
2. Heavy Industry	11.0620	2.1369	0.2030	13
3. Food	8.5143	3.8594	0.4981	13
4. Textiles	13.1649	1.0265	0.0038	13
5. Others	9.8482	2.3280	0.2399	13

TABLE 5

OUTPUT REGRESSED ON CAPITAL AND LABOR (1939 - 1963)

$$\log O = \alpha + \beta \log K + \gamma \log L$$

Industrial Group		b	Sb	$\bar{R}^2$	N
1. Manufacturing	K	0.6705	4.3706	0.9450	23
	L	1.0067	5.5579		
2. Heavy Industry	K	1.3227	2.4858	0.7784	23
	L	1.9348	6.0132		
3. Food	K	0.5874	2.2833	0.9226	23
	L	1.5300	4.5179		
4. Textiles	K	0.2576	1.6723	0.8474	23
	L	1.0283	5.3593		
5. Others	K	0.4355	2.6886	0.9013	23
	L	0.5086	1.9020		

TABLE 6

OUTPUT REGRESSED ON CAPITAL AND LABOR (1949 - 1963)

$$\log O = \alpha + \beta \log K + \gamma \log L$$

Industrial Group		b	Sb	$\bar{R}^2$	N
1. Manufacturing	K	0.3791	1.8337	0.9284	12
	L	1.1036	3.6067		
2. Heavy Industry	K	0.2488	0.8364	0.7456	12
	L	1.2577	6.2952		
3. Food	K	0.5157	2.3033	0.9371	12
	L	1.2492	3.4312		
4. Textiles	K	0.2270	1.1843	0.6773	12
	L	0.9570	2.4773		
5. Others	K	0.6403	1.9824	0.8469	12
	L	0.3636	0.7564		

Choice of Techniques and Prices of Factors of Production:

Given a set of assumptions related to the mobility of factors of production, it can be inferred that existing economic theory favors an inverse relationship between the choice of techniques and prices of factors of production.

The prices of capital and labor have changed considerably during the 24 years under consideration. The argument is based on the broadly accepted proposition that in Turkey during the industrialization process wages are increasing more rapidly than wholesale prices in general, and prices of construction and machinery in particular, while usually at the earlier stage of industrialization wages are more sticky. We intend to test this basic hypothesis and to attempt a calculation of the time lag between the decision to adopt a certain set of techniques and the effect of this decision on Capital and Labor.

Considering the following figures, the proposition that the wage rate tends to be higher and the cost of capital lower as the economy attains a higher level of economic development does not need any further proof, at least for the period under consideration.

	Nominal Wage Index	Const.Mat. Price Index	Mach + Equip. Price Index	Cons + Mach. Average
1939	3.9	8	7	7.5
1940	4.9	9	8	8.5
1941	4.6	12	10	11.0
1942	6.5	21	19	20.0
1943	10.4	28	25	26.5
1944	12.3	30	26	28.0
1945	14.6	30	25	27.5
1946	15.3	30	24	27.0
1947	20.3	32	26	29.0
1948	21.7	33	27	30.0
1949	22.8	31	25	28.0
1950	26.0	23	23	23.0
1951	26.9	27	23	25.0
1952	30.6	31	26	28.5
1953	36.7	30	26	28.0

Cotinued...

	Nominal Wage Index	Const.Mat. Price Index	Mach.+Equip. Price Index	Cons.+Mach. Average
1954	39.0	39	30	34.5
1955	42.8	46	36	41.0
1956	53.0	55	44	49.5
1957	60.4	59	50	54.5
1958	68.5	72	70	71.0
1959	86.5	93	95	94.0
1960	94.2	97	91	94.0
1961	96.7	96	95	95.5
1962	100.-	100	100	100.-
1963	112.4	103	97	100.-

Empirical Results:

We have attempted three different computations with the intention of testing the hypothesis that the choice of techniques is related to the relative prices of factors of production (labor and capital have been considered). The data in all three computations support the hypothesis that there is a negative association between factor intensity and factor price. In all cases the value of the coefficients are significant and they explain, in most cases, 50 per cent and more of the relation. The second feature common to all three computations is the increased significance of the regression coefficient and of the R^2 as we intorduce a longer and longer lag between the relative prices of the factors of production and the change in techniques identified as Total Stock of Capital, Incremental Capital or Capital Stock/Labor Input.

The results are summarized in compact form by means of a regression analysis using the equation of the form

$$(1) \quad \log K_t = \log \alpha_o + \beta \log \left[\frac{P_1 + P_2/2}{W} \right]_t$$

$$(2) \quad \log K_t = \log \alpha_o + \beta \log \left[\frac{P_1 + P_2/2}{W} \right]_{t-1}$$

$$(3) \quad \log K_t = \log \alpha_c + \beta \log \left[\frac{P_1 + P_2/2}{W} \right]_{t-2}$$

$$(4) \quad \log K_t = \log \alpha_c + \beta \log \left[\frac{P_1 + P_2/2}{W} \right]_{r-3}$$

where K_t denotes the Capital Stock in period t, P_1 and P_2 denote the price index for Construction Material and the price index for Machinery and Equipment respectively, and W denotes the index of wages in that part of the Public Sector covered by our analysis (i.e. the Manufacturing sector).

Capital stock at time t has been regressed on the relative prices of Capital and Labor at time t, t-1, t-2 and t-3.

The regression coefficients are given in Table 7 below. It can be seen from this table that the three lagged forms as well as the un-lagged form have the correct sign. The regression coefficient is significant in all four cases. $\bar{R}^2$ on the other hand shows a gradual increase from 0.50 to 0.54. A considerable part of the capital stock is explained by the relative prices of Capital and Labor, but there remains a large part to be explained by factors which have not been included in the regression analysis.

On the other hand the Durbin-Watson Statistic has deteriorated in the case of the one year lag, but has considerably increased in the two years lag and more so from the two years to three years lag. This indicates the presence of negative autocorrelation.

Instead of Total Stock of Capital we regressed Incremental Capital on Price of Capital/Price of Labor. The results are summarized by means of a regression analysis using the equation of the form

$$\log \Delta (XK)_t = A_t^{\beta}$$

$$\log \Delta (XK)_t = A_{t-1}^{\beta}$$

$$\log \Delta (XK)_t = A_{t-2}^{\beta}$$

$$\log \Delta (XK)_t = A_{t-3}^{\beta}$$

Regression coefficients are given in Table 8 below. It can be seen from this table that all the four coefficients have the correct sign. Moreover the regression coefficient is significant in all four cases. $\bar{R}^2$ improves as we move to more lagged relations though only a small part of the relation (around 25 per cent) is explained through this regression. The Durbin-Watson Statistic increases significantly when moving from a lag of one year to lags of two and three years; the difference is very small between the two year and three year lags.

The last regression is a more direct attempt to relate the Choice of Techniques (Capital Stock/Labor Input) to the relative prices of factors of production (Price of Capital/Price of Labor).

The regression coefficients of all four forms have the correct sign and are significant. $\bar{R}^2$ is gradually rising and indicates that the two year and three year lags explain a higher percentage of the relation. The Dublin-Watson statistic rising for all the three lagged relations and it is considerably lower for the unlagged regression.

Linear regressions have shown lower significance, lower $\bar{R}^2$ and, in most cases, lower Dublin-Watson statistics.

Implications of Choice of Techniques and Growth Rate of the Non-Farm Sectors:

In the section of our paper on unemployment we have attempted to determine the factors affecting the choice of techniques. Disregarding for a while what these factors are,

TABLE 7

TOTAL STOCK OF CAPITAL REGRESSED ON THE PRICE OF CAPITAL/ PRICE OF LABOR

$$\log K_t = \log \alpha_0 + \beta \log \left[\frac{P_1 + P_{2/2}}{W}\right]_t$$

	Durbin-Watson Statistic	b	Sb	$\bar{R}^2$	N
t	0.2392	-0.6594	-4.9247	0.5027	22
t-1	0.2064	-0.6498	-4.8599	0.5069	21
t-2	0.2564	-0.6449	-4.8813	0.5208	20
t-3	0.3581	-0.6359	-4.9552	0.5408	19

TABLE 8

INCREMENTAL CAPITAL REGRESSED ON THE PRICE OF CAPITAL/ PRICE OF LABOR

$$\log \Delta (XK)_t = \alpha A_t^{\beta}$$

	Durbin-Watson Statistic	b	Sb	$\bar{R}^2$	N
t	1.2107	-1.3223	-2.4067	0.1788	22
t-1	1.2365	-1.4974	-2.8386	0.2428	21
t-2	1.4433	-1.3572	-2.4021	0.1851	20
t-3	1.4937	-1.5719	-2.8201	0.2579	19

Standard Deviation is as follows for the four cases shown above: 1.1731; 1.1731; 1.1841; 1.2123.

TABLE 9

CAPITAL STOCK/LABOR INPUT REGRESSED ON PRICE OF CAPITAL/ PRICE OF LABOR

$$(XK/XL)_t = \alpha A_t^{\beta}$$

	Durbin-Watson Statistic	b	Sb	$\bar{R}^2$	N
t	0.5031	-0.2089	-2.5468	0.1925	22
t-1	0.8689	-0.2744	-4.2519	0.4370	21
t-2	0.7750	-0.3188	-5.9466	0.6206	20
t-3	0.9624	-0.2992	-5.0255	0.5480	19

let us compute the long term trend values by the least-squares method for the Capital/Labor ratio of the manufacturing sector under public ownership.

The least squares regression is

$$Y = 46128 + 450\ X$$

The trend values for 1939 are 40728 and for 1963 51528 showing a yearly increase of 0.975 per cent or roughly 1 per cent. Most of the actual C/L ratios of the first period are considerably below the trend values, all of the actual ratios for the six years preceeding the devaluation of August 4, 1958 are above the trend values, values for the three years following the devaluation are below the trend values. With the beginning of the planning period actual values for the C/L rates jumped considerably above the trend values.

On a closer study of the components of manufacturing it became clear that the four categories under which we grouped the public enterprises were displaying Capital/Labor ratios very different from each other. Computation of the long term trend values of the four categories of the Public Manufacturing sector has revealed basic differences.

The least squares regression for C/L of "other manufacturing industries" is

$Y = 42800 + 2186 X.$

The trend values are 16568 for 1939 and 69032 for 1963. Corresponding to a yearly increase of 5.1 per cent.

The least squares regression for C/L of 'Food' is

$Y = 57452 + 697 X.$

It shows a yearly increase of 1.2 per cent with trend values of 49088 for 1939 and 65816 for 1963.

The least squares regression for C/L of the 'Textile' sector.

$Y = 28034.5 + 308.7 X.$

It shows a yearly increase of 1.1 per cent.

As for C/L in 'Heavy Industry' it displays a decreasing trend.

$Y = 108038 - 1968 X.$

The actual data for C/L shows a sharp decline up to 1945 and another one from 1956 to 1959.

Labor Productivity

Labor Productivity in the Public Manufacturing Industry, calculated as Value Added deflated for every one of the four categories seperately, shows a continuous increase, with sharp declines in a couple of years (1942, 1949-1950, 1958). The lowest increase is in 'textiles', the highest in 'Heavy Industry'. Food and "Other Manufacturing Industries" are moving very closely around the average for manufacturing

The least squares regression for Manufacturing is

$Y = 16170 + 549.3 X.$

The trend value for 1939 is 9578 TL. (at constant 1962 prices) per worker, and the one for 1963 is 22,761.6TL. yearly per worker.

The yearly rate of increase in productivity per worker is 3.4 per cent.

C/L in 'Textiles' has the lowest rate of growth and the lowest capital per worker at the mid point. Labor productivity in' textiles' has the lowest rate of increase.

C/L in 'Food' has the next highest rate of growth and the highest capital per worker at the mid point, next to heavy industry. Labor Productivity of 'Food' increases at a higher rate, C/L in 'Other manufacturing Industries' has the highest rate of increase, and a higher capital per worker at the midpoint than 'Textiles'.

C/L in 'Heavy Industry' has the highest capital per worker at the mid-point. It displays a decreasing trend. But inspite of this the rate of increase of labor productivity is the highest.

Capital Productivity

We have been dealing with gross productivities without having attempted to separate them further. Capital Productivity is expressed as Value Added divided by the total capital stock both expressed in constant 1962 prices. It displays an ascending trend with sharp declines in 1942, 1949-50 and 1958. We noticed the same years when investigating the decrease in labor productivity. It is due to sharp declines in value added.

The least squares regression for capital productivity is

$Y = 353 + 7.85 X.$

The unit of capital being 1000 TL. worth of capital expressed in constant 1962 prices. The yearly rate of increase is 2.22 per cent at the mid point.

The four groups of the manufacturing Industry, do not display the same characteristics. 'Heavy Industry' and 'Food Processing' show a rising trend steeper than the average; for manufacturing 'Other Manufacturing Industries' and 'Textiles' show,on the other hand, a considerable decrease.

Implications of the Productivity Trends for Unemployment:

The data which we have used represent , as of 1963, 24 per cent of the total value added of large establishments in the manufacturing sector of Turkey. To what extent have we the right to extend the rate of increase of labor productivity of 3.4 per cent to the whole manufacturing sector ?

Let us first investigate to what extent the 3.4 per cent labor productivity in public manufacturing is applicable to public industry. Rough calculations on Labor Productivity of publicly owned industry show a much higher increase in productivity of 4 per cent yearly, due mainly to the considerable increase in labor productivity in mining and quarrying.

Can we assume that the industrial sector as a whole is displaying the same productivity? Less reliable and heterogeneous data point to the same range,with a lowest of 3 per cent to a highest of 4 per cent. In fact between the two population censuses of 1955 and 1960 productivity per worker displays a rate of increase of 4 per cent yearly; on the other hand if we add to this the figures for the last decade with 1955 as base, we come to the same result. This last exercise does not seem very reliable because of discontinuity in the data between 1960-1962, mainly due to the changing character of the Plan figures. A last computation has been done on what seem to be homogenous figures covering the First Five Year Plan period. The rate

of increase of labor productivity shows a yearly increase of 3.2 per cent for the period 1962 to 1967. For the same period construction shows a decline in labor productivity which does not seem plausible. Mainly as a result of this, labor productivity in all sectors except agriculture show an average yearly increase of 2 per cent.

The labor productivity figures derived from the population census show an yearly increase of 3 per cent between 1955 and 1960. They show a yearly increase of 4 per cent for the period 1955 to 1969.

Closing Remarks of this Section:

In this section we have attempted to look at the factors which were affecting the choice of techniques. We have brought under our regression the two factors which economic theory emphasizes most, the price of capital and the price of labor. The results were significant though they could not explain the whole problem.

Some of the limitations were due to the data itself: The industries under investigation were only a part of the manufacturing sector, they were those owned by the public sector. Because the decisions on the choice of techniques were made by government officials it seems less likely that their decisions would be solely determined by the relative prices of labor and capital. This might be one of the reasons for the low significance of the regressions. We would expect more significant results if similar data was available for the private sector, where entrepreneurial decisions are expected to be more closely related to relative factor prices.

Secondly, the indexes used in the regression analysis do not reflect fully the changes in factor prices. For wages we might be facing collection difficulties, but there might be a number of factors which create an undervaluation of capital. As has already been touched upon in the first section of our paper, the exchange rate has been kept constant for long periods between 1946 and 1958 and between 1958 up to the present. Both private and public sectors have taken advantage of the situation by importing

machinery at cheap Turkish Lira prices. As we approach the year of devaluation the advantage becomes bigger and bigger. As it can be noticed when studying the price indexes for capital goods, there is a continuous and smooth rise, which is far from reflecting the jumps that devaluations ought to have created in the import prices of capital goods. In fact, the capital goods indexes are based on the existing wholesale price indexes and prices of construction materials. Moreover price indexes for construction materials should not have been included in the analysis as the decision on the choice of techniques is not "to build or not build" but rather on putting more or less workers and more or less capital intensive machinery inside this building. Under these circumstances the price index for capital should have been built on the import prices of machinery and equipment and on the prices of domestically produced machinery and equipment. Such an index would have shown kinks at the devaluation years.

Thirdly, the regression has been less significant because the public sector, on which our regression analysis is based, is not very much aware of the consequences of the choice of techniques. The fact that no progress has been made in the Committee for the Reorganization of States Economic Enterprises on the subject of revaluation of the fixed assets of these enterprises for the past seven years is not a coincidence.

Fourthly, the monopolistic and oligopolistic markets in which most of the firms included in our study are working provide such high rates of profits that the calculation of the advantages of alternative technologies becomes very unimportant.

Fifthly, alternative technologies exist side by side in the same industry, even in the same firms, due mainly to the difficulty of importing new machinery which would replace the old.

Sixthly, even if the new machinery corresponds to certain factor proportions its impact will be unimportant because even in a country like Turkey with a limited stock

of capital the incremental capital is very unimportant in comparison with the stock and would not change the average composition of the total capital stock.

Seventhly, we made the assumption that for the period under consideration there is full use of the existing productive capacity. When we study the raw data for value added in the manufacturing establishments of the public sector or value-added per unit of capital,we find decreases of one or two year duration for the years 1942 (effect of the Second World War), 1949-1950 (political effects created by the Democratic Party coming to power), 1957-1958 (extreme difficulties in the import of spare parts and raw materials), 1962-1963 (effects of the coup d'etat of May 27, 1960).

Eightly, as was expected,labor productivity has steadily increased at roughly 35 per cent per year for the manufacturing sector as a whole, with productivity in the heavy industry rising considerably more, productivity in textiles roughly constant since 1945, productivity in food industries following the trend in manufacturing as a whole, and productivity in the other industries (cement, paper, fertilizers, leather, ceramics etc.) displaying a cyclical behavior.

It does not seem possible to generalize this trend in labor productivity of the public sector to the whole manufacturing sector, mainly because as a percentage the public sector has more big establishments than the private sector, so that even if productivity increases are higher in the big establishments of the private sector the overall productivity of the private sector might not be as large as the public sector's. [1] This increase in value added per worker will have important consequences in estimating the creation of employment from the rising production targets of the Five Year Plans. We shall investigate this problem further at the end of this section.

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[1] According to the 1964 Census of Manufacturing Industries there were 134,383 workers working in large Establishments in the Public Sector and 164,582 in the Private Sector. To these must be added 131,736 workers working in the small establishments of the public sector.

Vale added per unit of capital is also increasing at the same time at C/L is increasing. The yearly increase in productivity of capital for the 'Heavy Industry' and 'Food' is much higher than the increase in 'Manufacturing' as a whole. On the other hand productivity in 'Textiles' and 'Other Manufacturing' show rapid decreases.

Ninethly, it is quite probable that the decision-making in the public sector might be based on motives which are not so common in the private sector. Difficulties in establishing coordination among units of the public sector forces public sector managers to move to self sufficiency in the main and auxiliary services of the enterprises. This is something that the private sector will not do because it will increase unduly its fixed cost.

Capital Intensity, Productivity and Unemployment The next seven years:

In the first paragraphs of this section we will attempt to understand the explicit and implicit assumptions concerning productivity in the Five Year Plans. Secondly, using these productivity coefficients try to correct the under-estimations or over-estimations. Thirdly using our data on Public Enterprises and completing this data with other sources arrive at a set of productivity figures representative of the trend in the choice of techniques. Fourthly, we will try to use these corrected productivity figures to compute the implications of the choice of techniques on unemployment; a single period will be considered covering the years 1967-1977.

The choice of techniques and changes in productivity have been grossly under-estimated in the Five Year Plans.

The following table gives a comparison of the estimated and realized figures of increase in the employed population according to the First Plan, for persons of 15 years and over.

TABLE 10

EMPLOYED POPULATION

Sectors	First Plan estimates	Realization	Difference
Agriculture	700.0	213.1	- 486.9
Industry	316.0	375.5	+ 59.5
Construction	204.0	152.8	- 51.2
Services	890.0	474.0	- 416.0
TOTAL	2110.0	1215.4	- 894.6

Using Income and Employment Data presented by the Second Five Year Plan we arrive at a set of implicit sectoral productivity coefficients for the period 1962-1967.

TABLE 11

PRODUCTIVITY CHANGES 1962-1967 (1962=100)

Sectors	Income (1967)	Employ. (1967)	Prod. (1967)
Industry	158.7	135.8	116.8
Construction	147.0	147.9	99.9
Trade	146.3	119.3	122.6
Transportation	141.9	134.3	105.7
Services	146.8	140.4	104.5
Non Agricultural Sectors (TOTAL)	149.6	135.8	110.2

Sources: Second Five Year Development Plan, p.143 Table 59, p.12 table 2, and 1969 Yearly Programme, p.34 Table 1.

This data on productivity show to us that certain changes in productivity have been built in, ranging in ascending order from 4.2 per cent per year for Trade, 3.2 per cent for Industry, 1.1 per cent for Transportation,

0.9 per cent for Services and 0 per cent, or even slightly below, for construction. If we include Trade with Services, this new category has a trend of 2 per cent yearly. The overall productivity increase per year for all these sectors together is 2 per cent, with income increasing at 8.4 per cent and employment at 6.3 per cent per annum.

Assuming that the productivity changes which emerged from the First Five Year Development Plan will continue without change during the period covered by the Second Five Year Development Plan, we can compute changes in Employment by applying our Productivity figures to income targets of the Second Five Year Development Plan. This ought to be considered a very conservative approach because capital per worker in the Non-Agricultural Sectors has increased at a rate of 1.75 per cent per year during the First Five Year Plan Period. 1/ The effect of this increase in Capital per worker on productivity can be expected to be seen during the Second Year Plan Period, and employment projections should have considered this change.

TABLE 12

DEMAND FOR LABOR IN THE NON-AGRICULTURAL SECTORS FOR 1972

	Income(a) 1967=100	Employment(b) 1967=100		Employment (In thousands)		
		Computed	SPO	Com.	SPO	Diff.
Ind.	176.3	150.8	154.2	2147	2195	+ 48
Constr.	142.0	142.0	140.3	670	662	- 8
Transp.	142.0	134.4	129.5	456	439	- 17
Services	134.0	121.4	125.5	1898	1963	+ 65
Non Agric. TOTAL	148.2	136.2	138.4	5171	5259	+ 88

a) Source: Second Five Year Development Plan, p.76, table 36.

1/ The trend of C/L for the period 1939-1963 related to the Public Manufacturing Sector displays a rate of increase of 0.975 per cent per year.

b) Source : SFYDP, p. 148, table 65.
Our computations are based on index of Employment (1962=100) divided by Index of Income (1962=100) for 1967. Income targets for 1972 are then multiplied by this coefficient.

TABLE 13

CAPITAL INTENSITY, EMPLOYMENT, PRODUCTION AND PRODUCTIVITY

Index 1963:1940 Public Sector

	Production	Employment	Capital Intensive	Productivity
Industry	571	262	217	246
Manufacturing	550	306	162	217
1. Heavy	1080	287	61	429
2. Food	510	186	160	268
3. Textiles	326	315	80	127
4. Other	978	727	425	120
Mining + Quarrying	1104	208	713	278
Electricity	1100	416	250	227

Productivity in Industry:

The trend in productivity of the Public Manufacturing sector displays a 3.4 per cent increase per year. As has already been pointed out, there are additional reasons, mainly the increase in the Capital/Labor, which are expected to increase the productivity.

The trend in the productivity of the Industry as a whole shows a higher increase due to the effect of Mining and Quarrying which displayed considerable productivity increases. The Public Industry as a whole shows a rate of productivity increase of 4 per cent per year.

Testing the validity of this rate of productivity for the industrial sector as a whole we are faced with the same result for 1955-1960 as well as for 1955-1968.

The Second Five Year Development Plan implicitly assumes productivity increases per worker per year of 2.2 per cent in Manufacturing but no increase whatsoever in Mining and Energy. This implicit assumption about zero productivity increase for five consecutive years in sectors like Mining and Energy is totally unacceptable. Capital per worker in the Public Sector has increased by 2.5 times in Electricity between 1953-1963, and by 7.5 times in Mining between 1939-1963.

The relatively higher ratio for Manufacturing is also misleading because it is composed of numerous sub-sectors with no increase in productivity (Tobacco,Textiles and Apparel,Chemicals and Fertilizers, Cement, Glass, Ceramics) and Electrical Equipment with an increase of 0.7 per cent per year.

Productivity in Construction·

The lanners do not seem to have made up their minds about what to do with productivity in Construction. Increase in productivity is zero and even negative for most of the five years of the First Plan. The Second Five Year Plan follows the same tradition and practically assumes no increase in productivity. Investigation of this sector shows a rate of increase of productivity of 1 per cent for 1955-1960 and 2 per cent for 1955-1968.

Productivity in Transportation:

It has been assumed to be 1.3 per cent in the SFYDP. It is 8 per cent between 1955-1960, and 5 per cent for 1955-1969.

Productivity in Services:

In the SFYDP it is assumed to be 1 per cent. It is 2 per cent between 1955-1960 and 3.5 per cent between 1955-1969. Figures for Trade have been incorporated into the Services in the SFYDP. The SFYDP assumes a 2.6 per cent increase in productivity for Trade and 0.3 per cent for the remaining services.

TABLE 14

COMPUTATION OF UNEMPLOYMENT FIGURES FOR 1972 (1967=100)

Sectors	Income	Productivity	Index	Employment (In thousands)		
				Comp.	SPO	Diff.
Industry	176.3	121.7	144.8	2062	2195	133
Construction	142.0	110.4	128.6	607	662	55
Transportation	142.0	127.6	111.3	377	439	62
Services	134.0	115.9	115.6	1808	1963	155
Non-Agri. TOTAL	148.2	116.0	127.7	4854	5259	405

We have incorporated into this model the sectoral productivity figures which we discussed at length above. The yearly productivity increases assumed to be valid for 1967-1972 are, 4 per cent for Industry, 2 per cent for Construction, 5 per cent for Transportation and 3 per cent for Services, with an average of 3 per cent for the Non-Agricultural Sectors as a whole. The increase in employment corresponding to the increase in real income outside of agriculture is 5 per cent yearly. The difference between this computation and SPO's demand for Labor in 1972 is around 400, or 7 per cent of the total Labor Supply for the Non-Agricultural Sectors.

Total unemployment for the non-agricultural sectors thus becomes 875 thousand, or 15 per cent of the Labor supply which is estimated to be 5,729 thousand for 1972.

Total unemployment for the non-agricultural sectors is expected to become 1,180 thousand by 1977 assuming that the rate of growth of the non-agricultural sectors increases from 8 per cent to 10 per cent. It will thus continue to be 15 per cent of the labor supply which by 1977 is expected to become 7.98 millions. If the growth rate of the non-agricultural sectors for 1972-1977 remains at the level foreseen by the Second Five Year Plan unemployment is expected to rise to 1.78 million which means an increase of the ratio of Unemployment to Labor Supply from 15 per cent to 22 per cent.

VII. OUTLINE, CONCLUSIONS AND RECOMMENDATIONS

1. Economists have become increasingly aware of the implications of technological progress on growth and unemployment.

2. The components of technological progress include the productivity benefits of increased education, development of skills, improved health, innovations of the design or of the product, economies of scale, improvements in the mobility of resources and managerial efficiency.

3. Technology has contributed to the growth of the advanced countries because the preconditions were present. These preconditions do not prevail in the developing countries. For the full contribution of technological change to growth in the long run, the socio-economic structures unfavorable to development should be changed.

4. Transfer of technologies developed in advanced countries to developing countries can be a solution to a number of problems, except the following four:

4 (a) To develop technologies using factors in the same proportions as factor availabilities.

4 (b) To develop technologies corresponding to the size of the market in the developing countries.

4 (c) To adapt technologies to the conditions of the developing countries.

4 (d) To develop a capacity for identifying technological problems and possibilities in underdeveloped countries.

5. The developing countries do not have to be more advanced in all sectors, but in the long run they have to develop a technological advantage in some.

6. The choice of techniques by firms is based on the respective prices of the factors of production, and their productivities. The private versus the social choice of techniques are very different in the developing countries due to a number of disequilibriating factors which push individual firms to choose technologies more capital-intensive than the case would have been if prices were representative of factor availabilities. These sets of prices are the exchange rate, interest rates, political prices of public utilities and state owned enterprises, and wages.

7. Businessmen may think that they are facing a technology with constant coefficients generally of the capital-intensive types, because they may think that a certain foreign way of producing is the best, because plant engineers are accustomed to some specific western technology, because there is a psychological attraction in capital intensive technology, and because foreign exchange and credit availability determines the country of origin of the technology. Moreover, all the techniques are capital intensive as they have been developed in the advanced industrial countries.

8. Technological dualism refers to the case where different production functions are used in the advanced and the traditional sectors of the developing countries. The size of the advanced sector and the capital intensive character of the technology used there does not allow this sector to create employment opportunities for the excess labor from the traditional sector.

9. Continuing advances in technology have worked to the disadvantage of the developing countries through the deterioration of their international trading position and through the acceleration in the increase of their population.

10. Turkey is suffering from under-utilization of labor. There is open unemployment in the urban areas and disguised unemployment in agriculture and in other areas.

11. With this quasi-unlimited supply of labor and with subsistence wages it seems a logical consequence to use labor-intensive techniques in underdeveloped countries. But elaborate social security legislation and government encouraged union movements may produce wage rates in the non-agricultural sectors quite different from those prevailing in the handicraft and agrarian sectors, and compell entrepreneurs in the advanced sectors to use different factor proportions.

12. Can we say that this capital saving technique is the desired final solution to the problem of choice of technology? Capital-saving techniques have low productivity which will tend to perpetuate existing conditions in Turkey rather than change them. Unless the jump made by our country is a large one putting it at the most advanced technological level possible in at least the important branches, the development effort will degenerate into further underdevelopment.

13. At most it may be possible to use the low wage situation in an interim period, but in the long run, development aims at abolishing the very conditions that these techniques are based on.

14. There is evidence to show that in many fields the competitive position of our country in the world market is related to the capacity to initiate innovations rather than copy the existing ones. This is not a question of being in advance in all sectors and branches of production, but in the long term it will be very important to have a technological advantage in some.

15. There are a number of difficulties involved in the transfer of a technology from a developed to a developing country.

15 (a) The complexity of components and parts of the technology to be transferred.

15 (b) The technical gap between the firm making the transfer and the firm on the receiving side.

15.(c) The gap between the industry of the advanced economy and the industry of the developing economy.

15 (d) The balance of payments problems limiting imports.

15 (e) The difference in social environment.

16. Technologies developed in industrially advanced societies are generally of a scale and sophistication unsuited to the production conditions and the size of the market of developing economies. Efficient technologies can become inefficient when transplanted to developing countries due to higher costs and/or inferior products.

17. Success of the transfer of technology is a function, on the one hand, of innovation and, on the other hand, of the ability to adapt to change.

18. A choice has to be made concerning the degree of adjustment that an underdeveloped country should make on the imported advanced technology.

19. International firms contribute very little because they transfer very little of the division of labor as developed in the advanced country.

20. Underdeveloped countries need the ability to discover and develop techniques suitable to their resources and the international firms do not seem to be of much use for the solution of these problems, because their center of gravity is outside this sphere.

21. We attempted a quantitative evaluation of the choice of techniques for the public sector. Lack of data for the private sector did not allow us to make a more general study.

22. The hypothesis that as Turkey industrialized the capital/output ratios should have increased (or output/capital ratio should have decreased) is not supported by the data. The opposite hypothesis seems to emerge.

23. On the other hand the hypothesis that there is a negative association between factor intensity and factor prices is supported in all computations.

24. The trend of capital intensity for Public Manufacturing shows a yearly rate of increase of 1 per cent. The actual capital intensity is much below the trend for most of the first period, the actual figures are above the trend for six years preceeding the devaluation of August 4, 1968. Immediately following the devaluation actual values dropped below the trend.

25. The trend values of the four categories are very different from each other.

1.	Other Manufacturing	5.1 per cent
2.	Food	1.2 per cent
3.	Textile	1.1 per cent
4.	Heavy	Decrease

26. The yearly rate of increase in productivity per worker in Public Manufacturing is 3.4 per cent.

27. If the results are not very significant it might be due to the characteristics of decision-making in the public sector, where relative prices are not the only determining factors.

28. Our capital deflators do not reflect fully the foreign exchange rates. They display a continuous movement; they should have been kinked. Moreover, the construction index should not have been included because the choice is one between more machinery and equipment or more labor, rather than between investing or using labor.

29. The public sector is not very aware of the effects of different techniques.

30. The monopolistic and oligopolistic markets in which the firms are working provide such high rates of profit that the choice of techniques becomes unimportant.

31. The effect of incremental capital on the stock of capital is very small.

32. Cyclical changes have decreased the significance of the results.

33. The motive of self sufficiency might induce the decision-maker in the public sector to act differently from one in the private sector.

34. The implicit productivity coefficients of the first Five Year Plan range from 4.2 per cent for Trade, 3.2 per cent for Industry, 1.1 per cent for Transportation, 0.9 per cent for Services to zero per cent for Construction. With Trade included in Services the coefficient becomes 2 per cent. The non-agricultural sectors' productivity increase is 2 per cent with an income increase of 8.4 per cent and employment 6.3 per cent.

35. By applying the productivity coefficients of the FFYDP to the income targets of the SFYDP we observe an overestimation of employment for 1972, amounting to 48 thousand in Industry and 65 thousand in Services.

36. Productivity in Industry in the long run (for the last 30 years) shows a 4 per cent increase per year. When we contrast the implicit productivity ratios of 2.2 per cent for Manufacturing and zero per cent for Power and Mining with this long term trend we come to the conclusion that official productivity figures are grossly underestimated.

37. We computed the productivity changes in Construction to be 2 per cent (half of the productivity in industry) while official figures are very near zero.

38. Transportation shows increases as high as 8 per cent and as low as 5 per cent, while the official figure is 1.3 per cent.

39. Productivity in Services range between 2 and 3.5 per cent. The SFYDP assumes 2.6 per cent for Trade and 0.3 per cent for all the Service Sectors.

40. When we try to quantify the implications of the Choice of Techniques and Productivity trends for unemployment we are faced with an additional 400 thousand unemployed to be added to the 470 thousand computed in the SFYDP. Productivity increases of 4 per cent for Industry, 2 per cent for Construction, 5 per cent for Transportation and 3 per cent for Services have been assumed.

41. Total Unemployment for the non-agricultural sectors might be expected to become 875 thousand or 15 per cent of the Labor Supply for the same sector in 1972 and 1.78 million or 22 per cent of the Labor Supply for 1977. It is only if the Third Five Year Development Plan can increase the growth of income of the Non-Agricultural Sectors by 2 per cent, increasing it from 8 per cent in the SFYDP to 10 per cent in the TFTDP, that the unemployment rate can be kept at 15 per cent of the Labor Supply of Non-Agricultural Sectors while absolute unemployment will increase to 1.18 million.

IMPACT OF CONSTRUCTION ON EMPLOYMENT

(with special reference to India)

N.V.A. NARASIMHAM

I. Significance of construction

II. Characteristics of the Construction Industry

(a) Nature of demand
(b) Production processes and techniques
(c) Mechanisation and capital intensity

III. A Model of the Employment Sector in India

IV. Construction Employment in India

(a) Relative stagnation
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VII. Labour-output and Labour-productivity Ratios for Individual Construction Processes in the Different States of India

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X. Appendix: An Illustrative Schedule of Accounting Prices for Labour and Capital in Regions with Different Levels of Unemployment

XI. Select Bibliography

I. SIGNIFICANCE OF CONSTRUCTION

Construction is an important process in economic development, particularly in establishing the infrastructure of an economy. It is a lucky coincidence for the developing countries that in building and construction, they can fully realise the comparative advantage of their factor endowments. The products of construction,being generally customer-made,largely enjoy a sheltered market, while the inputs used in construction give a cost advantage to local resource use.

A major component of the fixed capital formation of a country is construction. As such, the level of employment in construction is very much dependent on the volume and pattern of total investment made in fixed assets. An important but less realised fact is that any increase in building and construction activity would increase not merely employment, but also gross domestic product, savings and investment in the country.

If past experience were an indication, the developed countries in the world differ from the developing ones in respect of not only incomes, savings and investment rates, but also the proportion of the total working force in construction and the percentage of national output from construction. A comparison of selected developed and developing countries shows that the smaller the proportion of the working force in construction, the lower the rates of growth of national income, saving and investment of a country (See Table 1).

II. CHARACTERISTICS OF THE CONSTRUCTION INDUSTRY

(a) Nature of Demand:

The construction industry produces durable goods for the households, for the enterprises, and for the development of the infrastructure of the economy as a whole. Unlike in the case of other industries, the products of construction are hetrogeneous, mostly produced on demand without being affected by the short-term vagaries of market demand. But they are affected by the yearly variations in the demand by households, enterprises and the government for construction.

TABLE I

INTERNATIONAL COMPARISON OF RATES OF GROWTH IN CONSTRUCTION, NATIONAL INCOME, DOMESTIC SAVINGS AND CAPITAL FORMATION

Country	% of economically active persons in construction	% of national output from construction	Per capita national income (in US $)	Gross domestic capital formation as % of G.N.P.	Gross domestic savings as % of G.N.P.
	(1)	(2)	(3)	(4)	(5)
Developed countries:					
Italy	(1965) 10.6	(1966) 8	(1967) 1020	(1967) 19	(1967) 23
France	(1962) 8.2	(1967) 9	" 1738	" 23	" 23
U.S.A.	(1965) 6.4	" 5	" 3303	" 16	" 18
U.K.	(1951) 6.3	" 7	" 1560	" 18	" 19
Canada	(1966) 6.2	" 6	" 2087	" 24	" 24
Japan	(1965) 6.2	(1966) 7	" 921	(1966) 34	(1966) 35
Developing countries:					
Philippines	(1960) 2.1	(1967) 4	" 233	(1967) 22 (1950) 8	(1967) 13
Ceylon	(1953) 1.9	(1966) 7	" 132	(1966) 14	(1966) 10
Pakistan	(1961) 1.2	(1967) 4	(1966) 108	(1966) 14	(1966) 11
India	(1961) 1.1	(1966) 4	(1967) 73	(1967) 11	(1967) 8

Sources: For figs. in Col. (1): I.L.O., Year Book of Labour Statistics, Geneva (1966)

For figs. in Col. (2), (3), (4) & (5): Pocket-Book of Economic Information (1969) Ministry of Finance (Govt. of India)

The household demand for construction depends on household incomes and savings, while the industrial demand for construction depends on the volume of industrial investment undertaken, wherein the share of machinery is generally higher than that of construction. On the other hand, the governmental demand is determined by the volume and nature of infrastructure investment undertaken. In the developing countries the scope of expansion of both private household demand and private industrial demand for construction is limited, apart from the fact that the latter demand is generally sporadic and unstable. This places a greater responsibility on the governments of the developing countries for the maintenance and expansion of the level of construction employment.

(b) Production processes and techniques:

A construction project may be split up into its constituent processes all of which may not take place at the same time. In the case of building, for example, there is first the earthwork to be completed, then the masonry work, then the carpentary and fittings, etc. Each such process may be carried out by different techniques; the earth work, for instance, may be performed with hand-spades or mechanical diggers; the carpentary work may be done with hand-tools or with powered-tools.

The total cost of any process depends on the scale of output planned, the technique chosen, and the prices at which the labour and capital inputs are evaluated. A process in construction may be evaluated for its efficient use of inputs, or for its comparative costs under alternative techniques.

(c) Mechanisation and capital-intensity:

A distinction is to be made for this purpose between the two technical ratios: (1) labour-output and (2) capital-labour. The former is an input-output ratio and serves as a measure of technical progress, i.e., progress of efficiency in input use, which takes place when more output is derived from the same quantity of input, or the same output from less quantity of input. On the other hand, the latter is a ratio of one input to another, and serves as a measure of progress of mechanisation or capital intensity. The two measures are not mutually exclusive of one other. Technical progress, however, takes place slowly and, therefore, it may be identified with gradual downward movements in the labour-output ratio, or gradual upward movements in labour-productivity. Mechanisation

takes place, on the other hand, in sudden jerks and its progress may be identified with steep downward movements in the labour-output ratio or with steep upward movements in labour-productivity.

In using the capital-labour ratio as a measure of capital intensity, the Bureau of Economic Affairs of the United Nations suggested in 1959* that capital intensity may be measured as a relationship of capital input to labour input. The factors are regarded as a flow. Capital input is measured by the value of effective physical depreciation of the given equipment during the period of actual operation. It is calculated by dividing the total experienced lifetime of equipment in hours by the yearly hours of operating use, over a 6 years' period.

Due to lack of reliable data on depreciation of equipment, we may adopt the following method for India:

(a) To obtain a measure of capital intensity for the country, the relationship of real gross fixed investment to total non-seasonal employment is estimated for the 15 years of development planning. The inverted employment elasticity of fixed investment is estimated to be 0.38. The employment elasticity of fixed investment in India is 2.64, which may be taken as a measure of the marginal capital intensity.

(b) To compare the progress of mechanisation of the individual processes of construction in the different States of India, the ratio of piece rate of wages to time rate of wages paid to workers employed in the individual processes of construction in the different States is taken as a measure of the inter-state progress of mechanisation. For the sake of uniformity, the piece rates and time rates of wages paid by the State P.W.D. contractors only are taken.

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* "Capital Intensity in Heavy Engineering Construction" ECAFE - Working Party on Earth Moving Operations.

III. A MODEL OF THE EMPLOYMENT SECTOR IN INDIA

The occupational distribution of the working force in India is conspicuous for its lack of diversification. Almost two-thirds of the total working force are self-employed as cultivators (52.8%), or in household industry (6.4%), professionals and others (6.0%). Only one-third of the total working force may be considered as wage-earners. Out of the wage-earners, agricultural workers who are mainly seasonal workers make up one-half, while the remaining half comprises workers in construction (1.1%), large-scale industry (4.2%) and others (11.2%).

The self-employed being more predominant in number than the wage-workers, any reference to employment in India has to be to the wage-workers from whom, again, the agricultural workers, whose employment is influenced largely by seasonal factors like climate, may be excluded in the present study. For the non-seasonal segment of employment, including employment in construction,* a simple empirical model is constructed on the basis of available data for 1951-66 covering the First, Second and Third Five Year Plans of India.

The changes in employment in India are influenced both by demand factors (such as production, fixed capital formation, etc.) and supply factors (such as changes in population, self-employment, wage-rates, etc.). On the other hand, the changes in wage rates are affected by the cost of living and the level of employment. The estimated equations show employment as being affected by wages and fixed capital formation; and the wages as being affected by the employment level and the cost of living. They are given below:

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* From a study on seasonal factors in construction employment, it is found by Guha Thakurtha that the Monsoon in India is not such a major deterrent factor as the winter in European countries. "Employment in the Construction industry - Does it have to be so stable?" Economic & Political Weekly, 21 March 1970, p. 525).

$$(1) \quad a = \underset{(0.06)}{0.126^{*}} \; I + \underset{(0.018)}{0.052^{@}} \; W + 0.06 \qquad (R = 0.77)$$

$$(2) \quad W = \underset{(0.22)}{0.01^{\phi}} \; a + \underset{(0.01)}{0.06^{\&}} \; p^{c} + 0.23 \qquad (R = 0.83)$$

where a = change in the total number of wage-workers other than agricultural workers (in millions)

I = change in total gross fixed capital formation (in billion Rs. at 1960-61 prices)

W = change in the index of wage rates (1960-61 = 100)

p^{c} = change in the working class consumer price index (1960-61 = 100)

& significant at the 1% level.
@ significant at the 5% level.
* significant at the 10% level.
ϕ not significant.

Equation (1) shows that an increase in fixed investment of 1 billion rupees (of 1960-61) would create regular employment for an additional 0.126 million workers. That is, to provide regular employment for an additional worker, it requires an additional fixed investment of Rs.8,000 at 1960-61 prices, or Rs.14,000 at 1969-70 prices. The incremental employment-investment ratio is rather high, and does not permit large-scale expansion of regular employment of wage-workers.

The investment elasticity of demand for labour is calculated to be 0.38. This gives a marginal capital-intensity of 2.64, showing that a one per cent increase in employment requires a 2.64 per cent increase in fixed capital investment.

The wage-elasticity of labour-supply is 0.50 which is higher than the investment elasticity of demand for labour. An increase in the wage-level would, therefore, call for a more than proportionate increase in fixed capital investment in order to absorb the additional supply of labour created by the initial wage-rise.

While wage changes have a considerable direct influence on the level of employment of wage-labour, the changes in the latter have a limited direct influence on the wage-rate. Equation (2) shows that an increase in employment of wage-workers by one million may cause the wage to rise but by a negligible percentage (0.008).

The wage-elasticity with respect to the cost of living of the same year is calculated to be 0.02. The wage response to the cost of living during the year is slight, as is the case with employment during the year.

IV. CONSTRUCTION EMPLOYMENT IN INDIA

(a) Relative stagnation

The percentage of the total working force in construction activity is one of the lowest for India, as may be seen from Table 1, Col. (1). Even the percentage of construction employment to total employment in all industries (excluding agriculture) remained stationary: Over the ten years from 1955-56 to 1965-66, national income and total employment, showed an upward trend, but the percentage of construction in total investment declined drastically from 70.3 to 54.6 per cent over the same years. As a result, the proportion of total employment in construction showed an almost stationary trend over these years, as may be seen from the following data:

	Real GNP (in billion Rs.) @	Real gross fixed investment as % of real GNP @	% of real gross fixed investment in construction@	Total employment (In Millions) ***	% of total employment in construction	% of real GNP from construction
	(1)	(2)	(3)	(4)	(5)	(6)
1950-51	100.1*	12.3	68.9	..	..	3.9
1955-56	117.4*	15.6	70.3	10.9	6.2	3.9
1960-61	139.4*) 140.4**)	14.8	63.8	12.1	7.0	4.5
1965-66	160.5**	20.1	54.6	15.5	6.5	4.9

@ Source: (i) Estimates of capital formation in India, 1948-49/1960-61

(ii) Estimates of capital formation in India, 1960-61/1965-66 - C.S.O. (Govt. of India)

* at 1958-59 prices
** at 1960-61 prices
*** excludes agricultural workers who numbered 31.5 millions in 1961.

(b) Employment structure

Buildings and irrigation works absorb the bulk (82.5 per cent) of the total construction workers in India. Next are the transport and communications projects. The distribution of construction workers in India in 1961, available by broad types of projects, is given below:

	No. (in '000)	%
Buildings	469	49.7
Irrigation	309	32.8
Transport	140	14.8
Communications	25	2.7
	943	100.0

Construction activity requires a significant number of semi-skilled and skilled workers of different callings and trades-masons, carpenters, blacksmiths, fitters, plumbers, welders, electricians, mechanics and machine operators, drivers, etc. The percentage distribution of workers engaged in construction activity in India in 1961 is given below:

Craftsmen and production process workers:	83.9
Administrative and Executive workers:	4.9
Clerical:	4.6
Professional and Technical:	2.6
Transport and Communications:	1.8
Services:	1.3
Others:	0.9
	100.0

As the products of construction activity are of different kinds - residential and commercial buildings, social capital works, such as schools, hospitals, and administrative office buildings, ports, harbours, aerodromes, roads, culverts and bridges, dams and various major and minor irrigation works, as well as installation and repairs of plant and equipment, the nature and number of wage-workers required for each type of construction work would be different.

(c) Capital cost of skilled labour

The construction industry cannot readily absorb either the previous backlog of unemployment or the new entrants to the working force if they do not possess elementary skills. Almost every one of the 338 districts in the country has a State industrial training institute/centre for the craftsmen. Besides, the industrial establishments have their own training programmes for the workers. The average recurring cost incurred in training the skilled workers is estimated at Rs.1,044 per annum per trainee in the Government training institutions for craftsmen. The total cost of training a skilled worker may be placed at least at Rs.2,000. The duration of, and the entrance qualifications for training some of the skilled workers are given below:

Trade	Duration of training	Qualifications for admission
1. Building constructor	2 years	Two standards below Matriculation
2. Carpenter	1 year	-do-
3. Black-smith	1 year	-do-
4. Plumber	1 year	-do-
5. Fitter	2 years	

The costs of training generally prohibit the training of all the workers. Most of the semi-skilled and unskilled workers pick up their skills while on their jobs. One problem to be faced in a large-scale training programme is to know the exact number required of workers of each category, and the training seats to be provided for, institutionally or otherwise.

(d) Casualness of employment

While the construction industry could be considered stable for reasons of its special market, construction employment is characterised by its casualness, irregularity and instability. A field investigation by S.N. Guha Thakurta shows that on an average the skilled workers in construction industry are employed for 9.3 months and the unskilled workers for 7.5 months in a year. The rest of the year they have to seek non-construction jobs or remain unemployed. An idea of the relative position of employment and unemployment of important categories of construction workers may be had from the following figures given by Thakurta*, based on a field study:

	No. of months of Employment in		No. of months of Unemployment,	
	Construction	Others	Voluntary	Involuntary
Skilled (all Male)	9.30	1.06	0.15	1.49
1. Masons	9.29	0.71	0.16	1.84
2. Carpenters	9.88	0.67	0.12	1.33
3. Fitters	9.90	0.60	0.10	1.40
4. Khalashis	8.00	2.19	0.18	1.63
5. Others	9.43	1.15	0.19	1.23
Unskilled (Male & Female)	7.48	2.32	0.07	2.13
Male	8.17	1.65	0.13	2.05
Female	6.80	3.00	-	2.20
All Workers	8.39	1.69	0.11	1.81

While the stability and expansion of construction employment depend very much on the volume and pattern of investment, the decasualisation of construction labour needs structural and organizational changes. The excessive supply of unskilled labour and their recruitment methods on the one hand, and the lack of close correlation between investment - planning and man-power planning on the other, are some of the important factors responsible for the instability in construction employment.

* Ibid.

V. WAGE-STRUCTURE AND INTEREST RATES IN INDIA

Investment decisions on construction projects, largely based on their comparative costs and returns, depend very much on the wage rates of construction labour and the interest rates at which the capital costs of production are estimated.

The construction workers in India are covered by a Minimum Wage legislation. They are mostly recruited and paid by contractors who undertake assignments of construction work in the private and public sectors. In 1961, the Ministry of Labour and Employment made a Survey of Contract Labour including those in construction. The Survey shows that in construction skilled workers got, on the whole, twice the wages of unskilled-workers during 1957-61. The highest wage rate differed from the lowest by about four times for the unskilled as well as for the skilled workers. The wage differences between the skilled and unskilled groups were not substantial.

For the skilled workers, the inter-State wage differences were more pronounced than interpersonal wage-differences. For masons, for instance, the daily wage rate ranged from Rs.1.75 in the State PWD Works in U.P. to Rs.9.00 in the State PWD works in Jammu and Kashmir. For carpenters, it ranged from Rs.2.00 for private buildings in the urban areas in Bihar to Rs.8.00 in similar areas in Bombay State, to Rs.8.06 in ship repair work at Calcutta port and to Rs.9.00 at the dam sites in the erstwhile Bombay State. For blacksmiths, the daily wage-rates varied from Rs.2.00 in urban private building in Bihar to Rs.8.00 at the dam sites in the same State. The plumber's daily wage rate varied from Rs.1.55 (plus D.A.) in urban buildings in West Bengal to Rs.6.50 in the Andhra State P.W.D. works. It is somewhat better for the fitters with a range from Rs.2.00 in private urban construction in Bihar to Rs.10.00 in the Mysore State P.W.D. works. Such large inter-state wage-differentials for skilled workers would arise from inter-state disparities in investment activity and employment opportunities, apart from differences in local living costs. But considering the capital costs of skilled labour incurred by the State Governments, the States having a net loss of skilled workers to other States would face the problem of "skills-drain" which makes it difficult for them to undertake future investments in construction on any large scale.

For unskilled (male) workers, the daily wage rates during 1957-61 ranged from Rs.0.88 in the State P.W.D. works in U.P. to Rs.4.09 at Calcutta port; and for unskilled (female) workers from Rs.0.62 again in the State P.W.D. works in U.P. to Rs.2.50 in private building in the urban areas of U.P. and Bombay. The wage range for different kinds of labour in various types of projects for the period 1957-61 are given in Table 2.

In addition to wages, the interest rates in India are also an important factor influencing the investment activity in construction - especially in the mechanisation of individual processes of contruction. Though there exists an unorganised money market, the organised money market in India has rapidly expanded and influenced the level of interest rates in general. The rates of interest on the loans advanced by banks are considerably lower than those ruling in the unorganised market. The industrial and public sector investments in construction which constitute the bulk of the total investment in construction are governed mainly by the interest rates in the organised money market.

A policy of low interest rates has been deliberately followed in India to promote domestic capital investment. The distribution of bank advances according to the rates of interest charged in the organised sector in 1960 and 1967 is given below:

Rate of interest charged	Amount advanced (% distribution) Sept.1960*	Rate of interest charged	Amount advanced (% distribution) Oct.1967*
0-2%	0.4	0 - 5.5	2.0
2-4%	5.9	5.5 - 7.5	4.9
4-6%	76.0	7.5 - 9.5	67.7
6-7%	15.2	9.5 - 11.5	24.1
Above 7%	2.5	Above 11.5	1.3

* on the last Friday of the month.

TABLE 2

DAILY-WAGE RANGES (1957-61)
(for Contract Labour)

	Private building (in urban areas)		Public Works (Building)			
			State P.W.D.		Central P.W.D.	
	Min.	Max.	Min.	Max.	Min.	Max.
Skilled						
Mason	2.00 (U.P.)	8.00 (Bombay)	1.75 (U.P.)	9.00 (J&K)	3.00 (Madras & Mysore)	7.00 (Bombay)
Carpenter	2.00 (Bihar)	8.00 (Bombay)	2.50 (Andhra, Kerala Orissa)	7.50 (Bombay)	3.00 (Bihar, Madras. Mysore & W.Bengal)	6.75 (Delhi)
Black-smith	2.00 (Bihar)	7.00 (Bombay, Delhi)	2.00 (Andhra)	7.00 (Assam, Orissa, Rajasthan)	2.50 (Punjab)	5.50 (Delhi)
Plumber	1.55@ (W.Bengal)	6.00@ (W.Bengal)	3.00 (Andhra)	6.50 (Andhra)	4.00 (Bombay)	6.00 (Bombay)
Fitter	2.00 (Bihar)	7.50 (W.Bengal)	2.00 (Madras)	10.00 (Mysore)	2.50 (Bihar)	6.00 (W.Bengal)
Unskilled						
Man	1.00 (U.P.)	3.00 (Bombay)	0.88 (U.P.)	3.50 (Bombay, Mysore)	1.25 (W.Bengal)	2.50 (Bombay, Rajasthan & Delhi)
Woman	1.00 (Andhra, Madras, Mysore, Orissa)	2.50 (Bombay, U.P.)	0.62 (U.P.)	2.50 (Bombay)	0.87 (Madras)	1.87 (Bombay)

continued...

	Irrigation Project (Dams)		Railway Construction Projects		Ship repairing (at ports)	
	Min.	Max.	Min.	Max.	Min.	Max.
Skilled						
Mason	2.50 (U.P.)	8.00 (Bombay)	2.50	6.00	-	-
Carpenter	2.50 (U.P.)	9.00 (Bombay)	2.50	6.00	4.00 (Bombay)	8.06 (Calcutta)
Black-smith	2.87 (U.P.)	8.00 (Bihar)	3.00	5.50	3.50 (Calcutta)	6.90 (Calcutta)
Plumber	-	5.00 (Bombay)	-	-	-	-
Fitter	2.25 (U.P.)	8.00 (Bihar)	3.00	5.50	2.53 (Calcutta)	7.75 (Bombay)
Unskilled						
Man	1.50 (Andhra, Bihar, Orissa, U.P.)	3.00 (Andhra, Bombay, M.P.)	1.12	2.25	1.06 (Madras)	4.09 (Calcutta)
Woman	1.00 (Andhra, Orissa, U.P.)	2.00 (Andhra, Bombay, M.P.)	0.75	2.00	-	-

Source: Survey of Contract Labour (Ministry of Labour and Employment) (Government of India) (1961).

@ Plus D.A.

While, in 1960, as much as 97.5 per cent of total bank advances were made at interest rates of 7 per cent and below, 98.7 per cent of total bank advances were made in 1967 at interest rates of 11.5 per cent and below. Though there was an upward revision of interest rates after 1960, the effect of which would partly be cancelled by the rise in the general price-level, the interest rates in India on the whole are relatively low in view of an overall scarcity of capital in the country.

VI. CASE STUDY FINDINGS ON ALTERNATIVE TECHNIQUES USED IN A DUTCH DRAINAGE PROJECT*

An interesting case study was made by the Netherlands Economics Institute, in 1960, on the comparative costs of alternative techniques adopted in the different processes of a Dutch drainage project in the new areas to be brought under cultivation. The general conclusions arrived at in this study regarding machanisation are of interest to the developing countries. They may be summarised as follows

(1) Mechanisation of a construction process is justified only when wage rates are high and interest rates low, and not so justified when wage rates are low and interest rates high.

(2) The urge to mechanise a process arises when the planned output is found to be large and standardized. The optimal degree of mechanisation that can be achieved at any time depends on the nature of the raw material dealt with by the machines, the universality or specialised nature of the machine, and the skilled, operational and auxiliary personnel available for the machines. The more specialised the machines the greater the degree of mechanisation possible.

(3) Labour-intensive methods need not necessarily mean slower production. There will always be cases where it is possible to put so many men on the job that output per unit time is the same for the non-mechanised technique as for the mechanised technique. In processes like excavation of earth, the adoption of labour-intensive techniques requires almost no prior skills on the part of the workers engaged.

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* A case study of a construction Process - Field Trenches - by G.K. Boon (Netherlands Economic Institute, April 1960). (Mimeographed Report)

(4) The production time per standardized performance declines with an increase in the degree of mechanisation. The number of man-days taken for a given piece of work would diminish and labour productivity would increase with an increase in the degree of mechanisation of a construction process.

VII. LABOUR-OUTPUT AND LABOUR-PRODUCTIVITY RATIOS FOR INDIVIDUAL CONSTRUCTION PROCESSES IN THE DIFFERENT STATES OF INDIA

The State P.W.D. works such as buildings and roads are mostly executed through private contractors. The contractors are responsible for the collection of men, materials and machinery required for the completion of their contracted parts of the project. The workers employed by the contractors are paid either on a daily wage basis or on a piece rate basis. Payment on a piece rate basis would take place where the work of a labourer could be recognised and quantified. In either system of payment, the worker supplies labour and the employer supplies the required materials, equipment and machinery. Where, in addition to labour, a worker is required to supply raw materials (as in the case of stone-cutters) or bring his own equipment (as in the case of carpenters) he is paid extra for it.

The time rate of wages depends on factors such as the Minimum Wage, living cost, sex, age and experience of the workers, as well as the market supply and demand conditions of labour. The piece rate is influenced by factors such as the nature of raw materials, equipment and machinery with which the worker is expected to work, and the scale of production. For instance, the piece rate for earth-work is influenced by the nature of the soil. Similarly, the capacity and nature of the equipment and machinery to be operated by the worker would influence his piece rate. The greater the degree of mechanisation of a process, the lower would be the piece rate.

When both piece and time rates exist in a State, their ratio can be conveniently taken as the labour-output ratio. In the Tables 3(a) to 3(d), Columns (1) and (2) show the piece and time rates for workers in four separate processes of construction - viz., earth-work, stone-cutting, masonry and carpentry - as paid by the P.W.D. contractors in the different States of India during 1957-61.*

* Contract Labour, Ministry of Labour and Employment, Govt. of India (1961).

For earth-work in Madras, for instance, the time rate per man-day is given as Rs.1.50, and the piece rate per 100 cubic feet as Rs.3.75. The number of man-days required by a time rate worker for a 100 cubic feet, as given by the ratio of piece rate (Rs.3.75) to time rate (Rs.1.50), would be 2.50, which may be taken as an approximate measure of the labour-output ratio for earth-work in that State. In Tables 3(a) to 3(d), column (3) gives the "labour-output" ratios for earth-work, stone-cutting, masonry and carpentry, in the different States of India.

A more popular concept however is "labour productivity" which indicates the output produced per man-day. It varies inversely with the "labour-output" ratio, and can be calculated as a ratio of the time to the piece rate. The labour productivities for earth-work, stone-cutting, masonry and carpentry in the different States are given in column (4) of Tables 3(a) to 3(d). The only difference between "labour-productivity" and "labour-output ratio" is that one is a quantity measure while the other is a time measure. Either of them can be used for our purpose of inter-state comparisons of techniques of production and efficiency of labour.

TABLE 3

PIECE AND TIME RATE OF WAGES AND LABOUR OUTPUT RATIO FOR CONTRACT LABOUR IN STATE PWD PROJECTS (1957-61)

3(a) EARTH-WORK

STATE	Average piece rate for 100 cu.ft. (Rs.)	Average Time Rate per Man-day (Rs.)	Labour-output ratio (Man-days per 100 cu.ft.)	Labour productivity (cu.ft. per Man-day)
	(1)	(2)	(3)	(4)
Madras	3.75	1.50	2.50	40
Orissa	3.25	1.88	1.73	58
Andhra Pradesh	2.50	1.63	1.54	65
Mysore	3.48	2.63	1.32	76
J. & K.	2.00	2.13	0.94	106
Maharashtra & Gujarat	2.00	2.38	0.84	119
Rajasthan	1.31	2.13	0.62	162
Bihar	0.85	1.88	0.45	222

3(b) STONE-CUTTING

STATE	Average piece rate for 100 cu.ft. (Rs.)	Average Time Rate per Man-day (Rs.)	Labour-output ratio (Man-days per 100 cu.ft.)	Labour productivity (cu.ft. per Man-day)
	(1)	(2)	(3)	(4)
U.P.	40.00	3.25	12.30	8
Bihar	29.00	3.00	9.70	10
Assam	30.50	3.75	8.15	12
Rajasthan	20.00	2.75	7.30	14
J. & K.	17.50	6.25	2.80	36
Maharashtra & Gujarat	8.75	4.50	1.94	52
Himachal Pradesh	4.50	3.25	1.38	73
Kerala	4.28	4.00	1.07	94

3(c) MASONS

	(1)	(2)	(3)	(4)
Madras	29.00	3.50	8.29	12.1
Andhra Pradesh	28.00	3.50	8.00	12.5
Uttar Pradesh	19.00	3.88	4.90	20.4
Mysore	20.00	4.50	4.44	22.5
Himachal Pradesh	23.00	5.25	4.38	22.8
Maharashtra & Gujarat	20.00	4.75	4.21	23.8
Orissa	19.00	4.75	4.00	25.0
Rajasthan	13.50	4.25	3.18	31.5
Kerala	11.00	4.25	2.59	38.6
Assam	12.50	5.50	2.27	44.0

3(d) CARPENTERS

STATE	Average piece rate for 100 cu.ft. (Rs.)	Average Time Rate per Man-day (Rs.)	Labour-output ratio (Man-days per 100 cu.ft.)	Labour productivity (cu.ft. per Man-day)
	(1)	(2)	(3)	(4)
Andhra Pradesh	1.50	3.25	0.46	2.2
Assam	2.16	5.50	0.39	2.6
Rajasthan	0.75	4.50	0.17	6.0
Orissa	0.78	4.75	0.16	6.1
Punjab	0.53	5.00	0.11	9.4
J. & K.	0.53	5.00	0.11	9.4
Himachal Pradesh	0.36	5.00	0.07	13.9
Maharashtra & Gujarat	0.20	5.75	0.04	28.8
Mysore	0.13	5.00	0.03	39.5

Source: Contract Labour, Ministry of Labour and Employment, Govt. of India (1961).

VIII. DEGREE OF MECHANISATION OF THE PROCESSES OF CONSTRUCTION IN DIFFERENT STATES

The population densities in the States of India may be taken to reflect their relative labour supply positions. It is of interest to study the labour-output ratios of the States in raltion to their relative labour supplies. In Table 4, we have consolidated the labour-output ratios for each State and given its population density. We may draw the following conclusions from a comparison of population densities and labour-output ratios of the different States in 1961:

1. The labour-output ratio for earth-work varied from 0.45 man-days in Bihar (with a population density of 267 per sq. km.) to 2.50 man-days in Madras (with a density of 259) for 100 cu. ft. of work. The inference is: though Bihar and Madras are both populous States with excess labour resources, the P.W.D. projects in these two States were carried out by different techniques, as suggested by the large difference in their labour-output ratios, - by a more labour-intensive technique in Madras, and by a less labour-intensive (or most mechanised) technique in Bihar.

TABLE 4

LABOUR-OUTPUT RATIOS IN STATE PWD PROJECTS
(during 1957-61)

Name of State (with polulation density)	Earth-Work (Man-days per 100 cu.ft.)	Stone-cutting (No. of man-days per 100 cu.ft.)	Masonry (No. of man-days per 100 cu.ft.)	Carpentry (No. of man-days per sq.ft.)
South India:				
Kerala (435)	n.a.	1.07	2.59	n.a.
Madras (259)	2.50	n.a.	8.29	n.a.
Andhra (131)	1.54	n.a.	8.00	0.46
Mysore (123)	1.32	n.a.	4.44	0.03
North India:				
Bihar (267)	0.45	9.70	n.a.	n.a.
U.P. (251)	n.a.	12.30	4.90	n.a.
Punjabb(220)	n.a.	n.a.	n.a.	0.11
Him. P.(n.a.)	n.a.	1.38	4.38	0.07
J & K (..)	0.94	2.80	n.a.	0.11
West India:				
Bombay (120)**	0.84	1.94	4.21	0.04
Rajasthan(59)	0.62	7.30	3.18	0.17
East India:				
Orissa (113)	1.73	n.a.	4.00	0.16
Assam (60)	n.a.	8.15	2.27	0.39

** Old Bombay State, which includes the present Maharashtra and Gujarat.

However, in South India and West India, the labour-output ratios in the States decreased as their population densities declined. Generally, the lower the density of population of a State, the more was the degree of mechanisation.

2. The labour-output ratio for stone-cutting varied from 1.07 man-days in Kerala (with a density of 435 per sq. km.) to 12.30 man-days in U.P. (with a density of 251 per sq. km.) for 100 cu. ft. of work. A stone-cutter engaged in the P.W.D. projects in Kerala takes one-twelveth of the time taken by his counterpart in U.P. This suggests the adoption of highly mechanised techniques in stone-cutting in Kerala, the most densely populated State with an excess supply of labour; while the relatively less populous State of U.P. adopted a more labour-intensive technique for stone-cutting work.

3. The labour-output ratio for masonry work in the State P.W.D. projects varied from 2.27 man-days in Assam to 8.29 in Madras. In these two extreme cases, a mason in Assam takes about one-third of the time taken by his counterpart in Madras. The nature of the materials used in masonry as well as the design of construction are known to vary a lot between these two States, being influenced by local materials and climatic conditions. The design and materials of contruction would make masonry more labour-intensive in one State and less labour-intensive in another. It is difficult otherwise to explain the very low labour-output ratio of 2.59 for Kerala, being a neighbouring State of Madras which has the highest labour-output ratio of 8.29. If the States are grouped according to their zones, it may be seen from Table 4 that the States within each zone have declining labour-output ratios for masonry as their population densities decline - except in the case of Kerala in the southern zone.

4. The labour-output ratio for carpentry in the State P.W.D. projects varied from 0.03 man-days per sq. ft. in Mysore to 0.39 man-days in Assam and 0.46 man-days in Andhra. A carpenter engaged in Mysore seemed to take one-fifteenth of the time taken by his counterpart in Andhra. Such a large production - time differential can be attributed only to the adoption of highly mechanised techniques in Assam and Andhra. The degree of mechanisation in carpentry was however not related to population densities and the general supply of labour in the States.

IX. CONCLUSIONS

(1) More than many other activity, construction activity is a great provider of employment and a direct promoter of economic growth. The level of employment in construction depends on the techniques of production adopted for the various processes of construction as much as on the volume and pattern of allocation of the total investment in fixed assets.

(2) As a measure of the employment potentials of alternative techniques of production, the concept of the labour-output ratio is of practical use, especially to regions and countries faced with unemployment.

Variations in the labour-output ratio for any process of construction can arise due to

(a) design and raw materials
(b) quality of labour
(c) techniques of production (labour-intensive or capital intensive).

The variations in the labour-output ratio due to (a) and (c) will generally be more pronounced than those due to (b) on account of the relative mobility of labour.

(3) Workers in certain processes of construction need prior skills. However the nature of materials used can make a difference to the employment potential of a process. In a process like masonry, the kind of materials used can make a substantial difference to the labour-output ratio. On the other hand, the materials for stone-cutting and carpentry being more specific than in masonry, the various sub-processes involved in stone-cutting and carpentry lend themselves to mechanisation, and the incentive to mechanise any sub-process will be more, the larger the planned output.

(4) On the other hand, in a process like excavation of earth, no prior skill is essential for a worker, and if any skill is desired it could be acquired in the course of a few days on the job. The operational simplicity of the process lends itself to labour-intensive techniques as much as to mechanised techniques. The adoption of labour-intensive or mechanised techniques in excavation has to depend on the surplus or deficit of labour in

the region or State concerned. Labour-intensive techniques need not always mean slower production. There can be many cases where by putting more workers on the job, the production time in a labour-intensive method could be made the same as that in a mechanised method.

(5) In the developing regions, the market wage and interest rates generally do not represent the true or equilibrium rates for labour and capital. For various reasons, such as the existence of minimum wages or the tendency of wages to rise with employment, the market wage generally tends to be higher than the equilibrium wage. The market rate of interest on the other hand tends to be lower than the equilibrium rate, for reasons such as a common banking system charging the same rate of interest for a similar purpose. As a result, evaluation of project (or process) costs in construction based on the market rates for labour and capital is likely to lead to indiscriminate capital-intensity and mechanisation.

(6) In the developing regions, the public authorities and investment agencies, while making investment decisions on construction projects, should evaluate these projects on the basis of equilibrium or accounting prices in preference to the market prices of labour and capital. An illustrative schedule of accounting prices for labour and capital in regions with different levels of unemployment is worked out and given in the Appendix. For a developing region, the accounting price of labour may be obtained by allowing a discount on the market wage, and the accounting price of capital by placing a premium on the market rate of interest, while making the rate of discount or premium vary with the levels of unemployment of the self-employed workers and the wage-workers in that region.

APPENDIX

AN ILLUSTRATIVE SCHEDULE OF ACCOUNTING PRICES FOR LABOUR AND CAPITAL IN REGIONS WITH DIFFERENT LEVELS OF UNEMPLOYMENT

Let R_1, R_2, ..., R_9 be the individual regions within a country, each having 40 per cent of its population economically active, equally divided into wage-workers (20%) and self-employed workers (20%), and also having a common market rate of interest of 10 per cent per annum set by the Central Bank, and a common minimum wage of Re.1.00 per day for the wage workers as fixed by the Government.

Suppose the percentage of unemployment of all workers varies from one region to the other. Then, let R_1 have full employment of all workers at a market wage rate of Rs.5.00; R_5, full unemployment of only wage-workers at a market wage rate of Re.1.00 which is the minimum wage acceptable to wage-workers; and R_9, full unemployment of all workers at a market wage-rate equal to the minimum wage of Re.1.00 acceptable to wage-workers. Conceptually, R_1 may be said to have equilibrium in both the labour and capital markets, while R_9 has equilibrium only in the capital market, though at the lowest level of saving and investment. Between these two extreme cases, lie the economic positions of all other regions of which R_5 may be taken as being typical. The unemployment levels and corresponding market wage and interest rates for the different regions are given in the following Table, columns (2), (3) and (6).

The accounting wage and interest rates may be defined as the equilibrium rates of the labour and money markets. For R_1 and R_9, the market rate of interest of 10 per cent may be taken as the equilibrium or accounting rate of interest. For R_1, the accounting wage would equal the market wage of Rs.5.00, while for R_9, it will be equal to zero as this is the opportunity cost of wage-labour in that region.

Region	Unemployment as % of population (%)	Market wage rate (Rs.)	Discount allowed (%)	Accounting wage rate (Rs.)	Market interest rate (%)	Premium allowed (%)	Accounting interest rate (%)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
R_1	0	5	0	5.00	10	0	10
R_2	5 (5+0)	4	10 (5x2)	3.60	10	10 (5x2)	11
R_3	10 (10+0)	3	30 (10x3)	2.10	10	30 (10x3)	13
R_4	15 (15+0)	2	60 (15x4)	1.80	10	60 (15x4)	16
R_5	20 (20+0)	1	100 (20x5)	0	10	100 (20x5)	20
R_6	25 (20+5)	1	100 (20x5)	0	10	80 (20x4)	18
R_7	30 (20+10)	1	100 (20x5)	0	10	60 (20x3)	16
R_8	35 (20+15)	1	100 (20x5)	0	10	40 (20x2)	14
R_9	40 (20+20)	1	100 (20x5)	0	10	0	10

Proceeding from R_8 to R_2, unemployment will be found to decrease first for the self-employed from R_8 to R_5, and then, for the wage-workers from R_5 to R_2. As the investment demand of the self-employed increases with their levels of employment, the market rate of interest of 10 per cent appear less than its equilibrium rate, and the market wage (sticky or rising with wage-employment) would appear more than its equilibrium rate. This will make investors increase their demand for machinery which is scarce, in preference to labour which is in excess supply. As a result, investment decisions in developing regions tend to result in indiscriminate capital intensities. This tendency may be checked by allowing a discount on the market wage and by putting a premium on the market rate of interest for the purpose of arriving at the equilibrium or accounting rates to be adopted for the evaluation of investment projects.

The equilibrium rate of interest for a developing region may be obtained by adding to the market rate a percentage <u>premium</u> equal to <u>a multiple of the percentage of wage-unemployment to population</u>. The multiple to be applied to the wage-unemployment percentage needs however to be raised with the employment of the self-employed workers, and lowered with the employment of the wage-workers. For R_5, if the multiple is taken as 5, the premium to be added to the market rate of interest will be 100 per cent (i.e., 5 x 20 which is its percentage of wage-unemployment); the accounting rate of interest will then work out to 20 per cent (10 per cent market rate + 100 per cent premium). For R_6 where some of the self-employed are still unemployed, and for R_4 where wage-employment has increased, the multiple may be reduced to 4, and the premium on the market rate of interest will be 80 per cent for R_6 (i.e., 4 x 20), and 60 per cent for R_4 (i.e., 4 x 15); the accounting rate of interest works out to 18 per cent for R_6 and 16 per cent for R_4. For similar reasons, the multiple for R_7 and R_3 may be reduced to 3, and their premiums and accounting rates of interest worked out. The computation of the accounting rate of interest for different regions with varying levels of unemployment is shown in columns (7) and (8) of the above Table.

The equilibrium or accounting wage for a developing region may be obtained by allowing a discount on the market wage at a percentage equal to a multiple of the wage-unemployment percentage of that region. The multiple to be adopted for full unemployment of wage-workers is, however, to be reduced with a decrease in wage-unemployment. For R_9 to R_5, wage-unemployment being 100 per cent, the multiple may be taken uniformly as 5; it may be reduced for R_4 to R_2 as wage-unemployment decreases. The discount to be allowed on the market wage is thus 100 per cent for R_9 to R_5, which declines to 60 per cent for R_4, to 30 per cent for R_3, and to 10 per cent for R_2 as the level of wage-unemployment declines. The computation of accounting wages for regions with different levels of unemployment is shown in the above Table, Columns (4) and (5).

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EMPLOYMENT POTENTIAL OF ROADS

V.G. Bhatia*

An attempt has been made in this brief paper to quantify the employment potential of road development and maintenance, with particular reference to the proposed allocation of funds for road development in India's Fourth Plan (1969-74).

The Fourth Plan document issued by the Planning Commission, Government of India, provides for an outlay of Rs.876 crores for road development.** Of this, Rs.418 crores are in the Central Sector and the remaining Rs.458 crores are for the States and Union Territories. Out of the Central outlay of Rs.418 crores, about Rs.90 crores is for the construction of major and minor bridges (but not including culverts which are included under the roads programme). The remaining Rs.328 crores outlay is mostly for improving/strengthening the existing highway system in the country so that, with the exception of perhaps Rs.40 to 50 crores, the remaining expenditure will all be on road developments where land acquisition is not required. Out of the State allocation of Rs.458 crores, 25 per cent might be considerd as earmarked for rural roads (i.e.Rs.115 crores). The rest of the allocation is for State highways and major district roads, and may also be considered mostly for strengthening/improvement of the existing roads not involving much land acquisition.

Tables 1 and 2 indicate the broad estimates of the cost of constructing/improving roads of various types including rural roads, single lane highways, 2-lane highways, 4-lane highways. These tables also give the estimates of the cost of road construction in terms of percentages of the different components involved i.e. on land acquisition, labour and materials such as stone, cement, steel,machinery.

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*The views expressed herein are those of the author only and not necessarily of the organizations with which he happens to be connected.

**Fourth Five Year Plan 1969-74, Planning Commission,Government of India,pp.339. One crores =10 million =100 lakhs.

It might be noted that a considerable part of the expenditure is on the labour component so that total labour component in the cost of construction/improvement of roads is more than what would be indicated by direct the expenditure on labour i.e., wages paid. If we consider 50 per cent of the cost of materials as the labour component of materials, then the labour component of road development, where land acquisition is not involved, amounts to as much as 70 to 80 per cent for rural roads and 60 to 70 per cent for other roads (see table 2). Out of the expenditure on labour 30 per cent may be considered to be expenditure on skilled labour and 70 per cent on unskilled labour.

As regards bridges, a rough figure for the labour component of total expenditure may be taken as only 30 per cent of the cost of bridges. Again skilled labour has a dominant role, accounting for as much as 2/3rds of the expenditure on labour, with only 1/3rd on unskilled labour.

On the basis of the above norms*, employment generated by the outlay for road development provided for in the Fourth Plan, works out to about 8 lakh men and women for the entire period of 5 years. This corresponds to the total investment of Rs.876 crores in five years, or an average of about Rs.175 crores per year. Thus the norm works out to about 4.6 lakh man-years per Rs.100 crores of investment. For details, see table 3. The actual employment will, however, gradually increase from a lower figure of say, about 4.6 lakh people to about 11.5 lakh people by the end of the Fourth Plan, in view of the fact that the allocations will gradually increase over the 5 year period from 100 crores in the first year to Rs.250 crores in the last year, the total allocation during the five year period being the equal to the total outlay provided.

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*Wages assumed are Rs.4 per labourer per day for an unskilled worker and Rs.8 per person per day for a skilled worker (for bridge construction, however, wages assumed are Rs.10 per skilled worker per day). For rural roads, wages assumed are Rs.3 per day (all unskilled). 300 days per year have been taken as the working days for converting man-days into man-years.

In addition, labour is required for the maintenance of roads. This is, however, not as much a function of the outlay for the road development in the Fourth Plan period, as of the total road length inherited and built up till the end of the Fourth Plan. At present, an amount of Rs.90 crores per year is being spent on the maintenance of Indian roads, both by the Centre and the States. This is likely to be over 100 crores by the end of Fourth Plan. In the case of maintenance expenditure, as much as 70 per cent is the direct labour component and the remaining 30 per cent is on the other materials etc. The total direct and indirect labour component may be taken to be 80 per cent of the total. Of the expenditure on labour, 75 per cent may be on unskilled labourers, and only 25 per cent on skilled labour. Thus, on the basis of the above norms, the number of people employed for the maintenance of Indian roads at the end of the Fourth Plan will be of the order of 5.3 lakhs. The total employment generated by road development and maintenance at the end of the Fourth Plan will, therefore, be of the order of 1.7 million men and women. This employment, of course, is likely to increase on the assumption that the actual allocation for the development of roads will progressively increase.

TABLE 1

ESTIMATED COST OF ROAD DEVELOPMENT (WITH LAND ACQUISITION)

		Rural Roads (Unsurfaced)		Highway (Single Lane)		Highway (2 Lanes)		Expressway (4 Lanes)	
		Rs.	%	Rs.	%	Rs.	%	Rs.	%
Cost per km.		16,512		1.5 lakh		2.0 lakh		5.0 lakh	
Land Cost per km.		6,605	40	18,000	12	20,000	10	40,000	8
Labour Cost per km.		5,779	35	45,000	30	60,000	30	150,000	30
Raw Material Cost per km.		4,125	25	87,000	58	120,000	60	310,000	62
Raw Material Required for Culverts, such as Cement, Stone, Bricks, Pipes, Steel, Etc.	Stone	3,300	20	56,550	37	78,000	39	186,000	37
	Asphalt			4,350	3	6,000	3	31,000	6
	Cement			8,700	6	12,000	6	31,000	6
	Steel			4,350	3	6,000	3	15,500	3
	Machinery			13,050	9	18,000	9	46,500	9

TABLE 2

ESTIMATED COST OF ROAD DEVELOPMENT (WITHOUT LAND ACQUISITION)

		Rural Roads (Unsurfaced)		Highway (Single Lane)		Highway (2 Lanes)		Expressway (4 Lanes)	
		Rs.	%	Rs.	%	Rs.	%	Rs.	%
Total Cost per km.		9,907		132,000		180,000		460,000	
Labour Cost per km.		5,779	58.33	45,000	34.09	60,000	33.33	150,000	32.61
Raw Material Cost per km.		4,125	41.64	87,000	65.91	120,000	66.67	310,000	67.39
Raw Material Required for Culverts, such as Cement, Stone, Bricks, Pipes, Steel, etc.	Stone	3,300	33.31	56,550	42.84	78,000	43.33	186,000	40.43
	Asphalt			4,350	3.30	6,000	3.33	31,000	6.74
	Cement			8,700	6.59	12,000	6.67	31,000	6.74
	Steel			4,350	3.30	6,000	3.33	15,500	3.37
	Machinery			13,050	9.89	18,000	10.00	46,500	10.11

TABLE 3

EMPLOYMENT POTENTIAL GENERATED BY
INVESTMENT IN ROADS DURING IV PLAN

Sector	Assumed Total Allocation (Rs. Crores)	Labour Component %	Expenditure on Labour (Rs. Crores) Skilled	Unskilled	Total	Man-Days (Millions) Skilled	Un-skilled	Total
Central	418							
Bridges	90	30	18	9	27	18.0	22.5	40.5
Roads with Land Acquisition	48	60	9	19.8	28.8	11.2	49.5	60.7
Roads without Land Acquisition	280	70	60	136	196	75.0	340.0	415.0
State	458							
Rural	115							
Roads with Land Acquisition	57	50	-	28.5	28.5	-	95.0	95.0
Roads without Land Acquisition	58	80	-	46.4	46.4	-	155.0	155.0
Other	343							
Bridges	50	30	10	5	15	10.0	12.5	22.5
Roads with Land Acquisition	43	60	8	17.8	25.8	10.0	44.5	54.5
Roads without Land Acquisition	250	70	52	123	175	65.0	307.5	372.5
						189.2	1,026.5	1,215.7

Man Years @ 300 days per year - 40.5 Lakhs
Men Employed for the full 5 years of the Plan - 8.1 Lakhs

THE EFFECTS OF TURKISH WORKERS GOING ABROAD ON LABOUR FORCE

Sabahaddin Alpat

I. Introduction
II. General Characteristics of the Turkish Population
III. Economically Active Population
IV. Turkish Workers going Abroad
V. Conclusion

I. INTRODUCTION

A new issue has arisen within the last 10 years which influences the economic and social characteristics of some countries and their population and labour force. In particular this is the flow of workers between countries of Europe

Scientist, demographer and state authorities, while at first concerned with the causes that prompted the workers into going abroad to work, are now turning their efforts to studying the economic and social consequences, both in terms of the supplying and employing countries.

The flow of labour is in the direction of developed countries from developing, especially underdeveloped countries, and the main reason for seeking work in other countries from the workers' stand point is lack of job opportunities and satisfaction in wages in his own country and the possibility of acquiring some kind of skill or profession in the country to which he goes.

The supplying country, by sending surplus labour to other countries, while on one hand eliminates many problems

which may arise due to the inability to meet job demands, on the other hand provides for itself a source of foreign currency brought or sent home by the workers and in addition, especially countries with abundant unskilled labour, gets a chance to provide itself with experienced labour.

Countries employing foreign labour are able to pay out less wages and thus reduce the cost of production, obtain an adequate supply of labour for fields in which their own labour supply is greatly restricted, and furthermore are able to curb the demands of labour unions for higher wages and fringe benefits.

While at first glance this flow of labour appears to have mutual advantages both for the supplying and employing countries, it has several significant drawbacks.

In short these are:

- Difficulties the workers have in adjusting themselves to the countries they go to (learning the language, finding accomodation, adapting to the customs and mores, giving up old established habits, etc.)

- The labourers having to leave their families behind thus resulting in the splitting of families, remaining apart for too long.

- Establishing new families, marriage or a second marriage with foreigners.

- The workers becoming disaffected and, after a while, considering the country they work for as their own and desiring to settle there.

- On their return the workers having difficulty in readjusting themselves to the society and their work.

- On their return the workers not being able to obtain satisfactory jobs or wages parallel to the ones they had abroad.

- The supplying country becoming unable to meet its own labour demand.

- As the demand for going abroad increases, employing countries giving priority to skilled labour and thus a decrease in skilled labour in the supplying countries.

- On their return some workers failing to obtain satisfactory jobs and income, and the danger of their becoming part of a great mass of socially disturbing elements.

- Foreign labour becoming an element against domestic labour in the wages market.

- An important clash taking place between domestic labour unions and employing labour unions and the governments being effected by this on a big scale.

- In case of foreign workers leaving their jobs and returning home the possibility of a significant crisis arising in some activity branches, scarcity in the labour force and a big increases in wages.

- Many workers settling down, by marriage or other legitamate ways, and thus employing workers take on the characteristics of attracting migrants.

Doubtless, many others may be added to the advantages and drawbacks stated above. However, to indicate the significance of the subject, here references are made only to the major points.

Since 1961 Turkey has also become one of the countries that sends a considerable number of workers abroad. Before offering an explanations about Turkish workers going abroad, it will be useful to give some general information on the Turkish population.

II. GENERAL CHARACTERISTICS OF THE TURKISH POPULATION

Compared to many others Turkey is a country where the rate of increase of population is rather high. According to the last three large population censuses the population of Turkey became 27.8 million in 1960 and 31.4 million in 1965, whereas it was 24.0 million in 1955. This shows a rate of increase of 15.7 per cent in the period of 1955-60 and 12.9 per cent in 1960-65.

At first it appears that there is a decrease in the rate of increase. However, this is not an actual decrease. Because, from 1961 on, a considerable number of Turkish workers went abroad to work and they were not included in the results of the 1965 population census.

Turkey is mainly an agricultural country with the majority of its population living in the villages. The distribution is given below:

TABLE 1

DISTRIBUTION OF POPULATIONS BY VILLAGES AND TOWNS*

Census Year	Total Population	Town Population	%	Village Population	%
1950	20,947,188	5,244,337	25.04	15,702,851	74.96
1960	27,754,820	8,859,731	31.42	18,895,089	68.08
1965	31,391,421	10,805,817	34.42	20,585,604	65.58

*According to the 1950, 1960 and 1965 censuses.

When the percentage of population in the villages and towns are compared, it becomes evident that there is a increase in favour of the towns, and that in Turkey a fast urbanization and industrialization is taking place.

TABLE 2

DISTRIBUTION OF POPULATION BY AGE GROUPS AND SEX*

(thousands)

AGE GROUPS	1955			1960			1965		
	T	F	M	T	F	M	T	F	M
Total	24064	11831	12233	27735	13591	14164	31391	15394	15997
0-14	9476	4526	4950	11427	5487	5940	13149	6322	6827
15-44	10437	5092	5345	11442	5584	5858	13057	6405	6652
45-64	3293	1694	1599	3858	1909	1949	3897	1937	1960
65+	820	500	320	979	591	388	1243	713	530
Unknown	38	19	19	50	21	29	46	18	28

*Major Age groups according to the 1960 and 1965 population censuses.

T - Total; F - Female; M - Male.

If the above table is studied closely it will be understood that the population in the 0-14 and 15-44 age groups are equal to each other and that in both censuses the 0-44 age group constitutes 83 per cent of the total population.

This indicates that the younger generation is dominant in the Turkish population and that there is a great potential for it to increase, both in terms of the present and the future.

III. ECONOMICALLY ACTIVE POPULATION

TABLE 3

DISTRIBUTION OF ECONOMICALLY ACTIVE POPULATION BY SEX*
in the age groups of 15-44 according to 1960 and 1965 censuses

(thousands)

15-44 Age Groups	1960	1965
Male	7,806.6	8,612.0
Female	7,492.7	8,341.8
Total	15,299.3	16,953.8
Percentage of General Population	55.12%	54.00%

TABLE 4

DISTRIBUTION OF 15-44 AGE GROUP

by places with population of less than 10,000 and 10,000 or more

(thousands)

	1960			1965		
	TOTAL	MALE	FEMALE	TOTAL	MALE	FEMALE
TOTAL	15,299.3	7,806.6	7,492.7	16,953.8	8,612.0	8,341.8
10.000+	4,561.7	2,582.6	1,979.1	5,701.8	3,176.6	2,525.2
-10.000	10,737.6	5,224.0	5,513.6	11,252.1	5,435.4	5,816.7

As can be seen in these tables, in 1960 while the economically active population between ages 15-64 formed 55.12 per cent of the general population, this ratio decreased to 54.00 per cent in 1965. Thus, it is evident that some decrease in this age group occured.

On the other hand, a considerable part of the economically active population lives in rural areas and, according to the last two population censuses, the population in rural areas is more than twice as much as the population of the cities.

TABLE 5

ECONOMICALLY ACTIVE POPULATION BY MAIN OCCUPATION

(thousands)

	1960			1965		
	T	M	F	T	M	F
Technical Personnel, Self-employed people	218	179	39	310	248	62
Businessmen & Admn.	342	309	33	354	308	46
Salesmen	326	322	4	388	383	8
Workers engaged in Agriculture	9,925	4,983	4,942	9,962	5,126	4,836

continued...

	1960			1965		
	T	M	F	T	M	F
Workers in transport & communication	250	247	3	287	284	3
Mining	53	52	1	63	62	1
Artisans, manufacturing & repairing	999	864	135	1,235	1,093	142
Service Workers	370	340	30	441	409	32
Unskilled workers	277	261	16	301	294	7
Workers in unidentifiable occupations or not reporting any occupation	3,567	666	2,901	4,900	962	3,938

T - Total; M - Male; F - Female.

TABLE 6

ACTIVE POPULATION BY TYPE OF ECONOMIC ACTIVITY

(thousands)

	1955	1960	1965
Agriculture	9,446	9,737	9,750
Mining & Quarrying	63	77	87
Manufacturing	726	885	961
Construction	200	290	351
Electricity, gas, water	16	15	26
Commerce, banking, insurance	341	404	392
Transport, communication	190	247	287
Services	496	677	836
Activities not adequately described	727	661	868
TOTAL	12,205	12,993	13,558

After examining the above tables we can observe that the percentage of agricultural workers decreases, while that in the manufacturing and services sectors increases.

The reason for this is the slowing down of the rate of increase in the agricultural sector to other activities on the one hand, and the departure of a part of the population to other countries as workers on the other. The increase in the manufacturing industry is directly related to industrialization.

IV. TURKISH WORKERS GOING ABROAD

a. The Number of Workers Going Abroad :

According to the records of the Turkish Labour Placement Office and employing countries the first flow of workers began in 1961. The number of workers, which was 1,476 at the end of 1961, became 19,137 in 1962, 174,822 in 1965 and 373,152 in 1970. Three hundred and thirty six thousand of these workers are employed in Germany, while 37,000 work in Holland, Belgium and in other European countries.

To go abroad as a worker it is necessary to apply to the Turkish Labour Placement Office. However, since many people make an application for work abroad and since they have to wait for a long time, many workers find jobs through the help of their relatives and friends who have gone before, and leave the country as tourists and work in European countries without applying to the Labour Placement Office.

It is estimated that the number of workers who go abroad without being registered is 40,000 by the year 1970. So this should be added to 373,000. Thus the number of Turkish workers who work abroad at present adds up to 415,000.

b. The Places Where Workers Formerly Lived and the Field in Which They Worked:

According to the surveys conducted for workers

who took their home leave or who returned to the country, 28.9 per cent of the workers who go abroad are from the provincial centers, 13.7 per cent are from the district centers and 57.5 per cent are from the villages.

Sixty three per cent of the workers who are from the villages want to return to their villages while 39.7 per cent want to live in the cities.

By branches of economic activity in which they were engaged, 39 per cent of the workers who work abroad were employed in the agricultural sector and 19 per cent in the construction sector when they were in Turkey.

c. Marital Status:

Five per cent of the workers who work abroad have never been married, 93.2 per cent are married, 1 per cent are widows or widowers, 0.8 per cent are divorced.

13.7 per cent of the married workers went abroad with their families, or their families joined them afterwards, 85.5 per cent left their families in Turkey.

23.6 per cent of the workers, who live with their families, live with 1, 13.9 per cent live with more than 2, 10.6 per cent live with more than 3, 5.4 per cent live with more than 4, 3.2 per cent live with more than 5 dependents. However, the family situation of 43.3 per cent of the workers is unknown.

d. Time Spent Abroad by Workers:

The number of workers who have indicated that they were returning to Turkey permanently is 31,652. Investigations, however, confirm that even those workers who indicated, in response to a survey at the customs gate, that they would not return to the countries of their previous employment have done so without applying to the Turkish Labour Placement Office.

According to the same survey, 13 per cent of the workers want to work abroad for 6-12 months, 24 per cent for 3-4 years, 23 per cent for 4-5 years, 20 per cent for 2-3 years and 11 per cent for more than 5 years.

TABLE 7

WORKERS GOING ABROAD, BY AGE GROUPS

Age group	Percentage
15 - 19	0.48
20 - 24	2.27
25 - 29	19.99
30 - 34	28.61
35 - 39	30.10
40 - 44	13.70
45 +	4.85

As can be seen in the table above, the age group 25-39 is the largest group by percentage. This group is also the most productive group in the economically active population. The percentage in the age group 25-44, which represented 23.99 per cent of the Turkish population in 1950, had increased to 24.62 per cent in 1965 and 24.85 per cent in 1965. Thus, the growth rate of this group in the period 1960-65 was much slower than of the period 1950-60. If we accept 415,000 as an estimated figure of workers working abroad (excluding families), 328,000 of this figure fall within the 25-39 age group.

Since 14 per cent of the workers have taken their families with them, 58,000 males or females of the same age will be with their spouses, so that a potentially productive segment of the population is working abroad.

V. CONCLUSION

Turkish workers having gone abroad in large numbers creates various problems:

1. In the beginning, only unskilled workers were going abroad. However, gradually skilled workers found working abroad attractive; thus the already limited number of skilled workers was further decreased and the Turkish economy subsequently suffered.

2. Although Turkey has entered the era of the planned economy and is developing rapidly, there are still not enough jobs for the expanding labour force. If labourers are to be sent abroad they should not be taken from the numbers of workers necessary for our own economy. It is not possible to control the labour flow abroad as long as demand exists. As mentioned above, considerable numbers of workers are going abroad with Tourist Passports.

3. Workers, whether skilled or not, who have the courage to realize their own desire to go abroad, are usually enterprising. For this reason, many of them who might have been the owners of business in the future are a great loss to the economy.

4. Workers who return home, depending on the degree of skill they have acquired abroad, receive better pay than the workers who have not gone abroad and thus raise problems.

5. In the agricultural Sector, in general, the whole family can be considered as part of the labour force. When the head of the household goes abroad and begins sending money home, the other members of the family stop participating in economic activity and become consumers.

6. Workers who have a skill are rarely able to find a job abroad which enables them to use their skill, so they are treated as unskilled labour. This prevents their gaining experience and advancing in their field.

7. Unskilled workers who go abroad and return without having acquired a skill will be unable to find a job and will further upset the balance between the supply of and the demand for unskilled labour. This type of worker can only be successful in running a business of their own.

8. People who were in the age group 0 - 15 and who have since become economically active will make it difficult to find jobs for the workers, whether skilled or not, who came back home.

9. Since the workers go abroad in their productive years, some industries won't be able to find sufficient labour, and wages may increase.

10. Production, on the other hand, both from the point of view of quality and quantity, is affected by the fact that skilled workers in large numbers leave their jobs.

We could have added many more social and demographic matters to the brief explanation given above concerning the characteristics of the Turkish population, Turkish workers abroad and their affect on the Labour Force and the Turkish Economy. One of them would be changes in the fertility rate caused by the absence of a large numbers of workers, separation and divorce problems in families, establishment of new families abroad, inability of returning workers to adjust to their environment and the reaction in both the workers'homes and the community.

In the past it was thought that it would be useful to encourage workers to go abroad to provide jobs for those who were unemployed, to gain foreign currency, to help them to gain experience and knowledge. But the failure of this policy is one of the main topics for discussions today.

To the extent to which a program that eliminates the negative effects on the social structure and the labour force of the countries in question can be applied, the exportation of labour can be profitable for the worker himself, for the country which sends him, and for the country to which he goes.

Otherwise, the inevitable negative effects of the labour flow abroad will offset the benefits gained, from an economic point of view, and may cause great economic, social and administrative problems.

THE PROBLEM OF URBAN UNEMPLOYMENT IN AFRICA

Charles R. Frank, Jr.

I. The Magnitude of Urban Unemployment
II. Rural - Urban Migration
III. Rural - Urban Income Differentials
IV. The Demand for Urban Labor
V. Implications of Urban Unemployment
VI. Policy Alternatives
VII. Conclusions
VIII. References

Why is unemployment a problem in Africa and in the other less developed countries of the World? In a totally subsistence peasant economy (and the economies of many African countries today are not far removed from such a state) unemployment is non-existent. The problem only arises when a modern capitalist sector is interduced into the economy and the wage paid by the capitalist sector exceeds the marginal productivity in the peasant or traditional sector. For, as Lewis and Ranis and Fei have shown us, this inevitably creates the conditions for a labor surplus - a very large supply of workers from the traditional sector at the going capitalist wage. A stream of migrants from the rural, traditional sector is to be expected, at least until marginal productivity in the traditional sector is driven so high that it approximates the capitalist wage. When does this happen? One could argue that even in the United States, we are just approaching this state of affairs. The traditional family farm was a very important segment of the American economy in 1929 when 20 per cent of the total labor force worked in agriculture. This traditional, low income, rural sector has provided the urban industrial establishment with a steady flow of migrants which seems to have abated only in the last few years,and agricultural employment is now only about 5 per cent of the U.S. labor force.

The creation of surplus labor, then, is what development is all about. But the reserve of surplus labor can

take different forms. It can exist as a pool of underemployed labor in the rural areas or it can be transformed into a large number of underemployed and openly unemployed persons in overcrowded urban areas. The form which it takes depends on the relationship between the rate at which migrants leave the countryside for the urban areas and the rate at which new urban job opportunities are created. There are a number of factors which give us reason to believe that the divergence between these rates is much greater in the developing countries of this century than it was for those countries which developed in the 19th century, and that the divergence promises to grow for some time in the future. Some of these factors are: extremely high rates of population growth, well developed systems of communications between rural and urban areas, improverishment of the agricultural sector, rapid strides in levels of educational attainment, the growth of modern cities with modern amenities and the impact of foreign culture in urban areas, rapidly rising industrial wage rates, and the transfer of capital intensive technologies from the developed to the less developed world.

The purpose of this paper is to examine the role of these various factors in the African context 1/, estimate the magnitude of urban underemployment and open unemployment which is likely to result, explore the implications for economic and political development, and evaluate various ameliorative measures which might be taken.

I. THE MAGNITUDE OF URBAN UNEMPLOYMENT

The magnitude of urban underemployment and unemployment is not very well documented. A number of people have attempted to make some educated guesses. Green (1967), for example, boldly suggests that the unemployment rate in the largest six cites of East Africa is about 25 per cent and about 50 per cent in the major urban centres of West Africa. Cliqnet (1969) cites sample surveys in Douala (1966), Yaounde (1966), and Abidjan (1963) which indicate rates of unemployment of 13 per cent, 17 per cent, and 20 per cent, respectively. Green (1969) cites surveys in the Cameroons which show the rate of unemployment to be 25 per cent in

1/ This paper will concentrate on Africa south of the Sahara

the two largest cities. Gutkind (1967) cites a 1963 survey by the Nigerian National Manpower Board which found that 15.5 per cent of the population of working age are unemployed in Lagos. In other Nigerian cities, the percentage is even higher, 19.7 per cent in Ife, 26.3 per cent in Onitsha, 30.8 per cent in Kadima and 34.6 per cent in Abeokuta. On the other hand, a labor force survey of Tanzania (see Ray (1966)) reveals a rate of unemployment of only 7 per cent in Dar es Salaam.

The wide divergencies in the estimated rates of unemployment is probably indicative of both wide differences in the severity of unemployment in various African cities and differences in definitions of unemployment and labor force participation, reliability of the surveys, and reliability of responses from labor force participants. For a typical urban dweller in Africa, the lines between employment, underemployment, and unemployment are never very well defined. Labor force participants include the wage earner in the modern large-scale establishment, the young man employed at irregular hours in his uncle's furniture shop, the middle-aged woman with a sewing machine making clothing on the verandah of her house, the maker of sandals from discarded rubber tires, the very ill-paid apprentice in a small tailoring establishment or carpentry shop, the petty thief, and the budding entrepreneur who purchases a pack of 20 cigarettes for Sh. 1.50, breaks bulk by opening the pack and realizes a profit of 33.3 per cent on his invested capital by selling single cigarettes to his friends for 20 cents apiece.

A more meaningful distinction than that of employed - underemployed - unemployed is between those employed in establishments employing more than 5 or 10 workers which are usually covered in annual labor surveys of many African countries and the rest of the urban labor force. The larger establishments are generally more capital intensive, pay much higher wages, follow modern accounting practices and can generally be characterized as modern sector establishments, as opposed to the smaller scale establishments which

are better characterized as traditional. Employees in traditional establishments are generally underemployed under most definitions of the terms, while modern sector employees can be thought of as fully employed. Since data are available on modern sector employment, the rate of under- and unemployment can be inferred by comparing modern sector urban employment with estimates of the labor force derived from population data.

Doctor and Gallis (1966) have complied considerable data on employment in the modern sector in African countries. For example, they estimate that non-agricultural wage employment in Nigeria is about 5 per cent of the total labor force. 2/ Since Nigeria is about 20 per cent urbanized, this implies that non-agricultural wage employment is about 25 per cent of the urban work force or that about three-quarters of the urban work force is either jobless or underemployed in the traditional urban sector. In Ghana, non-agricultural wage employment is about 14.5 per cent of the total population. Since Ghana is about 25 per cent urbanized, this implies that about 60 per cent of the urban work force is employed in the modern sector or that 40 per cent is either unemployed or underemployed. In East Africa, the picture is somewhat different. The small-scale traditional sector is not at all well developed and the great bulk of the urban labor force is employed in the modern sector. Unemployment and underemployment are high in the urban areas which is evident even to the most casual observer, but the Doctor and Gallis data reveal that the rates do not come close to those of West Africa.

Regardless of the level of underemployment and unemployment, it seems clear that they have been growing very rapidly. A 1955 labor force Abidjan survey was followed up by a survey in 1963 which indicated that the rate of unemployment had grown from 14 per cent to 20 per cent of the urban work force (see Clignet (1969)). Even more revealing are comparisons of the rate of growth of the urban population and the rate of growth of modern sector employ-

2/ Labor force is estimated at about 35 per cent of total population.

TABLE 1

SUB-SAHARAN AFRICA: URBAN POPULATION GROWTH

City	Year	Population (000)	Year	Population (000)		Annual Growth (per cent)	
				City Proper	Urban Agglom.	City Proper	Urban Agglom.
Salisbury	1946	69	1966		330		8.1
Dar-es-Salaam	1948	69	1967	273		7.5	
Brazzaville	1955	76	1961-62		136		8.7
Dakar	1945	132	1961		375		6.7
Accra	1948	136	1968	616	758	7.8	8.1
Nairobi	1948	119	1968		479		7.2
Abidjan	1955	127	1964		282		9.3
Monrovia	1956	41	1962	81		11.9	
Fort Lamy	1955	29	1964		99		13.6
Cotonou	1945	26	1965	111		7.5	
Mombasa	1948	85	1968		234		5.2
Bamako	1945	37	1965		165		7.8
Bulawayo	1946	53	1966		240		7.8
Lusaka	1950	26	1966		152		11.7
Yaounde	1955	38	1965	101		10.3	
Douala	1954	118	1965		200		4.9
Addis-Ababa	1951	400	1967	644		3.0	
Khartoum-Omdurman	1948	210	1967	390		3.3	
Luanda	1950	150	1960		225		4.1
Leopoldville (Kinshasa)	1946	110	1966	508		8.0	
Elisabethville (Lubumbashi)	1950	103	1966	233		5.2	
Kumasi	1955	75	1968	282	340	10.7	12.3
Lourenco-Marques	1950	94	1960		179		6.7

Source: United Nations, Demographic Yearbook, various issues, New York, and William A. Hance, The Geography of Modern Africa, New York, Columbia University Press, 1964, p.54.

ment. The rate of growth of African cities has been very rapid, ranging up to nearly 14 per cent per year since World War II and averaging about 7 per cent (see Table 1 which is an update of Table 1 in Frank (1968)). 3/ The growth of the urban labor force is probably a bit less than the growth in urban population, but of the same order of magnitude. 4/ On the other hand, the growth of urban employment has been quite sluggish. As Table 2 indicates, non-agricultural employment in the modern sector has grown very slowly in many African countries. Of the ten African countries listed in Table 2, seven have had rates of growth of employment of less than 1.5 per cent since 1955. Only Ghana, Nigeria, and Sierra Leone have had more rapid growth, but none of the rates of growth are much more than one-half of the rate of growth of the urban work force of about 7 per cent in most countries. Furthermore, all ten countries, save Ghana and Sierra Leone, experienced actual declines in employment between 1955 and 1963.

The implication of such discrepancies in growth rates is startling. Suppose that in 1955, the proportion of the urban labor force either openly unemployed or underemployed in the traditional sector was 25 per cent. If the differential between the growth of the urban work force and modern sector employment growth is 4 per cent, by 1970 the proportion unemployed or underemployed would be nearly 60 per cent. In another 15 years, by 1985 the proportion would be more than 75 per cent. In other words, if present trends continue, wage employment in the modern urban sector will rapidly become a very small proportion of the total urban work force in nearly all African countries.

3/ The weighted average rate of growth of the cities in Table 1 is 7.1 per cent when terminal populations are used as weights.

4/ During the first 10 or 15 years after World War II, most urban workers in East Africa were migrants who frequently left their families in the rural areas (see Elkan (1960)). In the last 10 years the work force has become more stable and much of the recent rural-urban migration is biased towards juveniles and females so that the work

TABLE 2

NON AGRICULTURAL EMPLOYMENT INDICES

(1963=100)

	Cameroons	Ghana	Kenya	Malawi	Nigeria
1955	112	62	117	101	n.a.
1956	114	69	115	109	101
1957	110	72	115	112	107
1958	110	76	110	115	107
1959	104	81	110	113	105
1960	100	84	112	110	113
1961	103	92	108	107	95
1962	80	97	107	100	120
1963	100	100	100	100	100
1964	102	103	122	92	130
1965	109	104	123	n.a.	n.a.
1966	113	95	137	n.a.	n.a.
Rate of Growth (per cent)	0.1	4.0	1.4	-1.0	2.5

	Rhodesia	Sierra Leone	Tanzania	Uganda	Zambia
1955	94	73	107	106	107
1956	101	73	114	105	116
1957	108	77	111	111	116
1958	111	81	109	112	116
1959	111	83	105	111	109
1960	112	85	107	112	108
1961	109	89	114	110	105
1962	105	94	111	105	101
1963	100	100	100	100	100
1964	98	104	104	101	106
1965	101	113	107	111	109
1966	101	114	114	111	n.a.
1967	104	110	n.a.	118	n.a.
Rate of Growth (per cent)	0.9	3.5	0.6	0.9	1.1

Note: n.a. means not available

Source: United Nations, Statistical Yearbook 1967, New York, 1968, pp.103-04. United Nations, Statistical Yearbook 1968, New York, 1969, pp.102-03.

II. RURAL - URBAN MIGRATION

The rapid growth in urban population is due mainly to a very high rate of rural-urban migration. The natural rate of increase of population in most African countries ranges between 2 and 3 per cent (see Caldwell and Okonjo (1968)). Estimates by Caldwell (1969) (p.13) that of the growth in Ghanaian cities since 1948 only one-fourth can be attributed to natural increase (taking into account the lower female to male ratio in urban areas), one-fifth is due to foreign immigration, and over one-half is the result of a rural-urban migration, are probably fairly typical of most of Africa.

Economists generally assume that rural-urban migration is a response to differentials in earning potential. Quite a few authors have emphasized other factors. Callaway (1960) and (1963) has emphasized the role of education in encouraging migration. Callaway and other (see Little (1965), p.11 and Ojow (1968b))have also emphasized the attractiveness of urban centers and an urban bias in the provisions of social and cultural amenities. Another factor which is often mentioned is the influence of transport and communications. The landless condition of peasants from overcrowded areas is given a predominant role by some authors such as Posner (1970). Others argue about whether it is the push factors, such as unavailability of land, or the pull factors, such as the attractiveness of urban life, which are the most important motivation for migration (see Clignet (1969) and Lux (1969)). This kind of argument, however, is about as relevant as one involving which blade of a scissors does the cutting. Finally, Kilby (1967) and Frank (1968) mention the probability of obtaining a job, as measured by the degree of urban unemployment, as a factor influencing migration. This concept was fully developed and its implications explored in a series of models in papers by Todaro (1969) and Harris and Todaro (1968a) and (1986b).

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force has probably not grown quite as rapidly as population (see Caldwell (1969), p.122 in which he cites census data to show a slight decline in the ratio of males to females from 1948 to 1960 in the urban areas)

A considerable body of literature is building up, however, which seems to indicate that income differentials are the most important explanation for migration patterns. Beals, Levy, and Moses (1967) conducted a careful study using Ghanaian 1960 census data. Their results show that income variables have the greatest elasticity and the highest t-ratio in all of their regressions.

Hutton (1968) analyzed data obtained from interviews of unemployed persons milling around factory gates in the urban centers of Uganda, and from interviews with returnees from the urban areas and potential migrants in the rural areas. The analysis of the interview responses supports rather strongly the hypothesis that "labor migration as a physical movement of farmers and school leavers to sell their labor for cash incomes can be primarily accounted for by differences in objective economic conditions..."

Caldwell's surveys (see Caldwell (1969), p.88) of potential and actual rural-urban migrants in Ghana showed that "the vast majority (88 per cent in the rural survey and 82 per cent in the urban surveys) explained rural-urban migration in terms of more money and a better standard of living in the town..." Gutkind (1967) interviewed unemployed migrants in Nairobi and Lagos and found that nearly "all come with the expectation of finding a job". Posner (1970) finds that a "great majority of workers on large scale farms in the Kenya highlands come from relatively poor areas."

One of the earliest studies on rural-urban migration in African is Elkan's Migrants and Proletarians (1960), a study of migrant laborers in Uganda's urban centers. Elkan observed that the composion of the urban labor force (by area of origin) was inversely related to relative earnings in rural areas. Migrants from Kigezi and West Nile districts of Uganda and the Nyanza province of Kenya are predominant in the urban work force. These areas are either very densely populated or dry and poor. They are some distance away from urban centers in Buganda and Busoga districts. Despite the fact that the rural areas of Buganda

and Busoga are fairly heavily populated, rural cash incomes from coffee and cotton sales are high. The Buganda and Busoga are, therefore, not attracted to wage employment to the same degree as more distant tribes from very poor areas.

Rado (1964), in a review of Elkan's book, cites a study by a United Nations team which reinforces Elkan's observations. The U.N. study done several years later confirms the predominance in the urban labor force of tribes from relatively poor areas and shows that their relative significance is even more important when one ranks tribes according to the proportion of taxpayers absent from their homes at the time of tax collection.

Perhaps the most ambitious attempt to date, to test various hypotheses concerning causes of migration, is in process by a team of researchers from the Institute for Development Studies in Nairobi, headed by John Harris and Michael Todaro. This team has conducted an extensive survey of migrants in Kenyan cities which has been completed but the data have not yet been fully processed. Preliminary results, however, seem to confirm the relative income hypothesis where urban incomes are measured in terms of expected income (see Todaro(1969) for a full elaboration of the expected income hypothesis).

Another important factor which emerges in much of the empirical work on migration is the distance between the sending and receiving areas. Distance is a highly significant variable in the analysis by Beals, Levy, and Moses (1967) when, of course, they control for income differentials and other variables. Their results show that a 16 per cent increase in distance is equivalent to about a 10 per cent decrease in the income differential. The Harris-Todaro preliminary results also indicate the strong significance of the distance variable. Distance is a proxy, of course, for the cost of moving and can be considered as reinforcing the relative (expected) income hypothesis when urban incomes are defined as the discounted stream of expected earnings less costs of moving.

A third important variable in the migration process is the demonstration effect with tribal and ethnic groups. That is, once a certain tribe has begun a pattern of migration to a particular urban area, the pattern becomes reinforced through time and has a cumulative effect. Hutton (1968) finds, for example, that deviations from a relative income explanation of migration are explained mainly by

> "variations in levels of aspiration towards cash earning which come from differences in the intensity of relative deprivation felt in terms of standard of living. This intensity will be largely dependent on the use of non-membership groups as reference categories, and this use of referents will be dependent in its turn on knowledge of non-membership groups derived from the quality and frequency of contacts outside the home area." (p.148)

The pastoralist Karamojong tribe in Karamoja, for example, does not provide many migrants to the urban areas, but this is explainable in terms of a lack of reference groups in Karamojong society who have had experience in urban areas. The tribe is out of touch with modernizing influences, and communications from Karamoja to the urban areas are poor. The West Nile area of Uganda, however, which is poor but not quite so badly off as Karamoja, provides a steady stream of migrants to the urban areas despite the long distances which must be traveled. Several decades ago, the sugar plantations conducted massive recruiting compaigns in West Nile to obtain workers for the plantations which are situated relatively close to the urban areas of the south. A pattern of migration from West Nile has now been established which has spilled over to a considerable degree from the sugar plantations to the urban areas.

Caldwell (1969) detects "chain migration in quite an extreme form" in Ghana (pp. 137-38). He attributes this less to the use of referent groups and more to the fact that when a potential migrant has relatives in town this increases the "flow of information and permits easy and cheap visits to town" (p.138). "Village families without

relatives in town, however, are unlikely to send members to visit town." His survey shows that "most migrants find out what town is like by visiting it" (p.137). Caldwell emphasizes the importance of cheap and easy transport in Ghana as a means of facilitating information flows, but finds "very little evidence that mass communications play a significant role in stimulating the migrant flow" (pp. 138-39).

Other writers such as Gutkind (1967) see the presence of relatives in town as facilitating the flow of migrants, as relatives often provide the new migrants with a temporary home and often give him money and food during the period that he is seeking a job. After a while these kin-based urban relationships may break down but they are often supplanted by tribal-based associations in the towns (see Gutkind (1967) and Little (1965). These voluntary tribal associations provide the new migrant with support of various kinds, including aid in finding jobs.

The Harris-Todaro team also find a good deal of evidence for the cumulative pattern in migration flows. Thus the cumulative effect seems a fairly pervasive one. The various explanations, relating to reference groups and information networks, easing the transition from country to town, probably all contribute to this observed pattern.

While there is strong evidence that relative incomes, distance, and demonstration effects play an important role in migration, there is less assurance that "bright lights theory" or"urban amenities hypothesis" have validity. Beals, Levy and Moses (1967), however, provide a partial confirmation in their study which shows that the degree of urbanization in both the sending and receiving areas are significant variables. Thus, ceteris paribus, migrants are more likely to be attracted to areas which have relatively more urban amenities if the degree of urbanization is regarded as a proxy for the level of urban amenities. Furthermore, the Beals et al results indicate that people with more contact with urbanized areas are more likely to migrate, perhaps because they have acquired a taste for the "bright lights" of urban life.

Although the spread of primary education in Africa has often been accused of heavily contributing to the urban drift (see Harbison (1967), Lewis (1969), and Calloway (1960) and (196_)) the little evidence available seems to refute this hypothesis. Beals, Levy, and Moses (1967) actually find that the education variables are highly significant but with the wrong sign. That is, the higher the educational level in the sending area the less is the tendency to migrate, although the migrants from any particular area tend to be more educated than the general population in that area. The results of the Harris-Todaro study may provide an explanation for this seemingly paradoxical result. Harris and Todaro have noted that the rural-urban expected income differential for the relatively uneducated persons is approximately 40 per cent while the differential for educated persons is almost 100 per cent. There is the strong suspicion, then, that if one controls for income differences, the relative degree of education is not an explanatory factor in rural-urban migrations.

Finally, there is some slim evidence that landlessness may be an explanatory variable in rural-urban migration. Ownership of land is a particular problem in Africa. The attachment to the land is strong. Elkan (1960) has described the typical urban worker in Uganda as one who frequently returns to his land between periods of work in the town. The Nigerian urban dweller often maintains a home in the country to which he returns every year at harvest time, a dual existence which is possible with the cultivation of tree crops which require little maintenance during most of the year and have peak labor demands only at harvesting. Although the pattern of frequent returns to the land is dying out (see Rado (1964) and Caldwell (1969), pp.167-169), the vast majority of urban workers still think in terms of retiring to the land (e.g. Caldwell (1969), p.198).

Landlessness among peasants in a particular agricultural area is often associated with a high population density and low per capita incomes. But landlessness may have its own distinctive explanatory power, particularly in terms of net migration [illegible]. Posner (1960) discovered

significant differences in the behavior of landless vs. non-landless wage employees on large scale farms in Kenya. The workers with land in their home areas seem to have a higher rate of turnover and to be less committed to wage employment. Thus, the lack of land may inhibit return flows and increase the net migration from a particular area.

The lack of land is becoming increasingly acute in many parts of Africa. With very high and accelerating rates of population growth in most African countries(from 2 to 3 per cent per annum), more and more areas are becoming extremely densely populated. Migration from densely populated to less densely populated agricultural areas is very restricted because of long established tribal hegemony in certain regions(see Eicher et al (1970) and Etherington (1965)). Before the colonial powers came to Africa great migrations could take place as tribes with growing populations could encroach on the tribal lands of other tribes with more stagnant populations. If disputes arose, they could be settled by war or the threat of war. After administrative boundaries were drawn by the colonial powers (in many cases in rough accordance with areas of tribal hegemony) tribal land use patterns have become more rigid.

Inheritance and lineage patterns also play a role in determining the access to land. In societies where land rights are passed on to the eldest son, for example, the younger sons, blocked from the use of family land and unable to find new land in their densely populated tribal area have only one alternative: wage employment. Thus they migrate to an urban area where their chances for wage employment are the greatest.

III. RURAL-URBAN INCOME DIFFERENTIALS

In most African countries, rural-urban income differentials are very great. In some they are growing at an extremely rapid rate. Uganda is perhaps an extreme case. According to Knight (1967), although output increased, agricultural incomes remained the same, largely due to a

43 per cent fall in coffee prices. On the other hand, minimum urban wages tripled during the same period from 31 per annum to £ 90 per annum 5/.

In Nigeria, Lewis (1967) (p.42) notes that "urban wages are much more than twice a farmer's income." Since 1950-52, prices paid to farmers by marketing boards in southern Nigeria have declined by 25 per cent, while minimum wage scales of the federal government increased by 200 per cent over the same period.

In Kenya, average earnings of African employees in the non-agricultural sector rose from £ 97 in 1960 to £180 in 1966, a rate of growth of about 11 per cent per annum. Estimated family income in the small-farm sector was only £ 57 in 1960 and rose to £ 77 in 1966, a growth of about 5 per cent per annum. Thus urban wages rose more than twice as fast as agricultural incomes. By 1966, the average wage in the urban sector was about 2 1/2 times the average family income on the farms. (See Ghai (1968),p.20.)

Rado (1967) (p.3) reports that in Tanzania "it seems that real per capita rural incomes approximated 1961 levels in 1966 and had been somewhat lower in 1965 and possibly also in 1964. On the other hand, real per capita wage incomes had increased over 50 per cent during this period. Virtually all of the 1961 to 1966 increase in personal consumption was accounted for by the growth of wages and salaries..."

According to Berg (1965) (p.190) "wage earners in most African countries have substantially improved their position in recent years relative to the other main African

5/ The minimum wage "is an 'effective' rate in most(African countries)... It determines the wage paid to about 50 per cent or thereabouts of the wage earning labor force which is unskilled and paid at the established minimums. It is also the key rate in the wage structure; when minimum wages change, the entire wage structure tends to move with it." See Berg (1965), p.186.

groups in the money economy.... In West African cities between the late 1940's and the early 1960's, real wages rose in the order of 30-50 per cent. In the Congo, between 1950 and 1958, real wages doubled, and in Southern Rhodesia between 1949 and 1958, they rose by almost 70 per cent. Everywhere wage increases far outpaced improvements in income of farmers."

In countries of Africa where rural-urban income differentials have widened most rapidly, this has resulted from the combined effects of (1) depression of rural incomes due to rapid population growth and declining land/labor ratios as well as declining land fertility (see Allan (1965), and Rutenberg (1968)), (2) declining world market prices for peasant agricultural exports, and (3) very rapidly rising statutory minimum wages or minimum wage scales of government employees. Recently, however, not all these factors have been pervasive throughout Africa. Agricultural prices have tended to stablize in the middle and late sixties. While urban real wages have undoubtedly increased very rapidly over the last decade in most of East Africa and Nigeria, real wages in a number of West African countries have been stagnant or declining during the sixties. Eicher et al (1970) (p.16) cite data from various sources indicating that real minimum wages have fallen sharply in Ghana (-7.4 per cent per annum between 1960 and 1967) Mauritania (-40 per cent per annum from 1961 to 1967) and Niger (-3.0 per cent per annum from 1962 to 1967), and have been virtually stagnant in Senegal (-1.3 per cent per annum from 1959 to 1967), the Ivory Coast (-0.9 per cent per annum from 1960 to 1967) and Sierra Leone (+0.7 per cent per annum from 1960 to 1965). Dupriez (1965) (p.464) reports that the minimum monthly wage for a married man with three children fell by more than 50 per cent from June 1960 to March 1964. The decreases in real minimum wages in West African countries has been the result, in most cases, of severe inflation of the urban price structure without concomitant increases in minimum wage scales.

IV. THE DEMAND FOR URBAN LABOR

Despite the very rapid growth in non-agricultural output in most African countries over the last decade (see Frank (1968) pp. 252-255), growth of employment has lagged far behind. The large differential between output growth and employment growth implies very rapid increases in labor productivity in most African countries (see Frank (1968), pp. 257-262).

Increased real wages are probably the most important factor explaining the slow growth of non-agricultural employment opportunities. Rough comparisons of real wage data (described in section III above and Table 2) show a high degree of negative association between real wage increases and the growth of employment. Ghana, where real wages have fallen by more than 7 per cent, has experienced the most rapid growth in employment. In Sierra Leone, growth in real wages has been moderate and employment has increased at a rapid pace. Where real wages have increased very rapidly in the sixties, as in Kenya, Uganda, and Tanzania, employment opportunities have been virtually stagnant.

Real wage increases have reduced the growth of employment for a number of reasons. First, real wage changes have increased the tendency to use more capital intensive techniques both in the private sector and in government. Baryaruha (1967) substantiates this tendency in the industrial sector. Gutkind's (1967) quote from The East African Standard (Nairobi) of November 14, 1963 vividly illustrates the effect of high wages on government works programs.

> Mr. Dawson Mwanyumba (the Minister of Works, Communications and Power) told the House that his Ministry was not considering building more roads with hand labor because the cost was more than double that of using machines.
>
> He quoted figures for the Thika Road Project

> of Shs. 108/- a foot for hand labour and only Shs. 40/- a foot when the work was done by machines.
>
> The Minister agreed that the Thika Road work had been done to ease unemployment but said Government policy had now changed.

As long as government finance is a bottleneck in Africa, government sponsored construction will become more and more capital intensive as wage rates increase more rapidly than government resources.

Second, real wage increases have forced entrepreneurs to economize on the use of unskilled labor by training and supervision of their workers, and prodded managers into seeking better industrial relations policies with their workers to increase productivity. The most carefully documented investigation of these factors is contained in Baryaruha (1967).

Finally, real wage increases can shift the modern sector's output sharply in the direction of more capital intensive lines of production and away from the labor intensive service sectors and construction activities. Wage increases can have a particularly deleterious effect on the level of real government services performed. Uganda provides a striking example of this phenomenon. Wage employment in Uganda is more than 50 per cent in the public sector (see Frank (1968), p. 255), and over one-half of government employment is local government employment. When minimum wages were increased in Uganda in 1962 by almost 60 per cent (from about Shs. 75/- per month to Shs. 120/- per month), the effect on government employment, and particularly local government employment, was immediate and disastrous. Government employment fell by about 30 per cent (see Clark et al (1964)). Many local governments had to cut down sharply on their administrative staff, and road maintenance was sharply curtailed.

The effect of wage increases on employment in government, services, and construction is particularly

important in Africa where these sectors account for about 80 per cent of total employment, except in those countries where mining employment is more than 10 per cent of the total. The fall in employment in many African countries from the late fifties to the early sixties (particularly in East Africa) can be attributed largely to the sharply declining output and employment in the construction sector and the slow growth of output combined with slightly declining employment in the labor intensive service sectors (see Baryaruha (1967)).

There have been very few serious attempts to measure the wage elasticity of employment. Todaro and Harris (1969) claim to have established that the wage elasticity of employment (holding output constant) in Kenya is about 0.8 and not significantly different from unity. Their results are quite aggregative and do not separate out the effects of changes in the composition of output. Their aggregative results include all manufacturing, trade, commerce, and services except for the public sector. They do present separate results for manufacturing, trade and commerce, and other services. The meaning of a wage elasticity of employment close to unity for trade and commerce and other services is difficult to fathom. These sectors use virtually no capital. With output constant labor cannot be substituted for capital or any other factor. Their results for manufacturing are probably heavily biased because of the manner in which national accounts are estimated in Kenya. "Value added for manufacturing, mining and road transport is estimated by applying a fixed ratio from the censuses of industry to an estimated wage bill derived from the annual survey of employment." (See Van Arkadie and Frank (1969), p.204) Since this fixed ratio remains the same for several years at a time, any estimate of the wage elasticity of employment will automatically be close to unity. Their results, obtained by regressing changes in value added per employee on changes in wages per employee, are not surprising. Nevertheless, their main conclusions are still valid - changes in wages can have a very depressing effect on the growth of employment.

Other than increased wages, there are probably a number of other factors causing the apparent rapid increase in labor productivity in Africa. First, rapidly increasing real labor costs caused by frequent labor disruptions and unrest (see Kilby (1967)), threaten the existence or continued profitable operations of many firms. Unionization in most of Africa is a fairly recent phenomenon and has been accompanied by quite a number of wildcat strikes and jurisdictional disputes. This has led many employers to think in terms of reducing their labor requirement through mechanization and tighter management practices. (See Frank (1965), pp. 110-14 for the effect of unionization on sugar manufacturers in East Africa.)

Second, increasing quality of the labor force, particularly through on the job training and increased experience in a factory environment. This factor can be especially important in parts of Africa where the labor force in any new factory is so inexperienced in the ways of modern production that considerable ignorance and many predjudices must be overcome before an efficient working force is obtained. As an example, the management of a new steel rolling mill in Jinja, Uganda, wondered why the extraction and stacking of hot steel rods from the furnance was proceeding so slowly until it was discovered that the workers were afraid of the bars which resembled serpents as they coiled and twisted in being pulled from the furnace. Efficiency increased quickly, however, once the workers became accustomed to this strange sight.

Third, disembodied labor-saving technical change results from better training and management. The relatively young nature of most of the industrial plants in East Africa means that start-up problems and the initial experiments with work procedures, scheduling of operations, etc., cause labor productivity to be relatively low on the average. As the age of the industrial establishments increases, these initial problems are overcome and efficient methods of training workers and organizing production are gradually discovered through trial and error.

Fourth, increased capacity utilization of certain types of public utilities and mining establishments can result in increased productivity of the overhead-type personnel, such as maintenance and administrative workers. Railways expand their ton miles rapidly, without adding much to overhead and maintenance personnel which form the bulk cf their employment. Mines expand tonnage output very significantly by adding only a few production workers. (See Frank (1968), pp. 259-261 for evidence of rather startling growth of productivity in railways and the extractive industries.)

Many of these kinds of increases in labor productivity fall under Leibenstein's notion of x-efficiency (see Leibenstein (1966)). Singh (1970) discovered in his cross-country analysis of labor demand that increases in x-efficiency tend to be greater in countries with a low per capita income. Thus we expect the x-efficiency factor to be particularly important in the growth of labor productivity in Africa, with depressing effects on the growth of labor demand.

Finally, one often encounters the argument that a major reason for rapid increases in productivity is the influence of foreign technology embodied in the capital goods imported from the developed countries. Little research is directed toward improved technology which is capital saving rather than labor saving.

V. IMPLICATIONS OF URBAN UNEMPLOYMENT

What are the implications of a continued rapid growth in urban unemployment? Some authors (e.g., Miracle (1970)) have argued that the effects of urban unemployment in Africa are mitigated by the extended family system. No one really goes very hungry or is without some form of shelter since relatives usually provide for the basic necessities of the urban unemployed. One may also point out that ties to the land are strong, and when the going gets really rough the unemployed have the alternative of returning to the home area.

A decade or so age, these arguments might have had considerable validity. Mitchell (1962), (p.241), for example, points out that the African population of Northern Rhodesia fell from 32,000 in November 1930 to 7,500 in July 1932. Thus nearly 25,000 "were able to slip back unobtrusively to their tribal homes and stay there until things improved." Elkan (1960) gives a thorough discussion of the intricate ties to the rural home areas and the pervasive impermanency of the urban labor force as late as the middle fifties in Uganda. Since the middle fifties, however, the urban work force has tended to become much more stabilized. Ties to the home area and frequent migration back and forth have become less and less important. (See, for example, Rado (1964), Mitchel (1962) and Caldwell (1969), pp.167-69). The extended family relationships in towns have a tendency to break down as the income earners who support great numbers of their relatives and fellow tribesmen become increasingly resentful of the expense of maintaining large numbers of dependents and their loss of privacy. (see Gutkind (1967) and Pfefferman (1967)).

It is frequently maintained that growth of migrant employed urban workers tends to increase urban unrest and lead to violent political upheavals (see Green (1967), Eisenstadt (1966) and Hauser (1957), p. 249). If this is true, a revolutionary might welcome the prospect of further aggravation of the unemployment problem. But we have very little evidence, one way or the other, to substantiate the hypothesis that urban unemployment and radical protest are associated. Weiner (1969), in his analysis of voting patterns obtains some indication that unemployment increases the degree of support for the Communist party. Clignet's (1969) preliminary results are not very enlightening as to the association between unemployment and political unrest. Very little research has been done in this area.

Although the evidence is inconclusive as to whether unemployment is associated with radical and revolutionary behavior, it does seem clear that unemployment does induce pathological social behavior. Gutkind (1967) encountered

a high incidence of anti-social behavior and high crime rates among the unemployed in Nairobi and Lagos and Althabe (1967) reports an unusual degree of latent revolt and refusal of the unemployed of Brazzaville to integrate themselves into organized society. Clignet (1969) finds a positive association between unemployment and prostitution, sickness, and broken families in Douala and Yaounde.

Perhaps the result of unemployment that ought to be feared the most is the very real possibility that it will lead not to a revolution, which gives the lower social and economic strata more power and more opportunity, but to frequent violence and social and economic disruption followed by increased repression by the regime in power of all political activity by disadvantaged groups.

VI. POLICY ALTERNATIVES

In attacking the problem of unemployment one can think in terms of measures which operate on the demand for urban labor, those which mainly affect the supply of labor in the urban areas by reducing the flow of migrants from rural areas, or those which operate on both. Policies which operate on demand only are probably of little use. If the expected income hypothesis of Todaro (1969) has any validity, then ceteris paribus, increasing the growth of urban employment also increases the rate of rural-urban migration since the probability of getting a job is enhanced. If the increase in the rate of migration exceeds the increase in the growth of employment, the level of unemployment may actually be exacerbated in terms of absolute numbers. The conditions under which this will happen can be formulated in terms of the Todaro model.

The probability of obtaining a job in the urban sector is

$$(1) \quad \pi = \gamma N/(S-N)$$

where γ is the rate of urban job creation, N is the level of urban employment and S is the supply of urban labor.

If w is the urban wage rate and r is the average rural income, then the <u>expected</u> rural urban income differential is

$$(2) \quad d = w.\pi - r$$

or

$$(3) \quad d = w \frac{\gamma N}{(S-N)} - r$$

The basic assumption of the Todaro model is that the supply of urban labor is a function of the rural-urban income differential.

$$(4) \quad S = f_s (d)$$

Suppose now that the rate of urban job creation is a function of the urban wage w and a policy parameter a, which operates on demand.

$$(5) \quad \gamma = f_d (w;a)$$

where we assume that $\delta \gamma / \delta a$ is positive. If a policy shift increases the growth of demand for labor, the increase in the urban labor supply is

$$(6) \quad \frac{\delta S}{\delta a} = \frac{\delta S}{\delta d} \frac{\delta d}{\delta \gamma} \frac{\delta \gamma}{\delta a}$$

Differentiating (3), we have

$$(7) \quad \frac{\delta S}{\delta a} = \frac{\delta S}{\delta d} w \frac{N}{(S-N)} \cdot \frac{\delta \gamma}{\delta a}$$

The absolute number of unemployed increases if the increase in labor supply exceed the increase in the number of new jobs created, i.e., if

$$(8) \quad \frac{\delta S}{\delta a} > \frac{\delta (\gamma N)}{\delta a} = N \frac{\delta \gamma}{\delta a}$$

Combining (7) and (8), we obtain

$$(9) \quad \frac{\delta S}{\delta d} w \frac{N}{(S-N)} \quad \frac{\delta Y}{\delta a} > \frac{N \delta Y}{\delta a}.$$

or

$$(10) \quad \frac{\delta S/S}{\delta d/d} > \frac{d}{w} \cdot \frac{(S-N)}{S}$$

That is, the absolute level of unemployment will increase if the elasticity of urban labor supply with respect to the expected urban-rural income differential exceeds the urban-rural differential as a proportion of the urban wage times the unemployment rate ((S-N)/S). In most African countries this implies a very low elasticity. If the expected urban-rural differential is 40 per cent of the urban wage and the unemployment rate is 20 per cent, the level of unemployment will be exacerbated if the elasticity of the urban labor force is greater than 0.08.

Perhaps the best advice an economist can offer is to pay very close attention to the level of urban real wages. A reduction or at least slow growth in urban wages has a double edged effect in that it tends to reduce the rate of rural-urban migration <u>and</u> increase the demand for employment. Reductions in real wages are not impossible in African countries. In a number of countries such as Ghana and Sierra Leone, wages have been held in check by a combination of restraint in raising money wages and the effects of inflation in reducing the purchasing power of wages. Unions are not as well organized nor is labor able to exercise the same degree of political power in forcing wage increases as is the case in most Latin American countries. (See Berg(1969)).

Without wage restraint, efforts to stimulate employment by reducing the capital/labor ratio, either in the public or private sector or by political pressures on employees such as was done in the famous 1964 Tripartite Agreement in Kenya, are likely to have little effect and may actually worsen the unemployment problem. Furthermore, measures to increase employment without a concomitant effort at wage restraint are likely to be very costly. In order to stimulate labor absorption in the private sector, the government must either subsidize (alternatively reduce taxes on) the use of labor or tax the use of other factors

(alternatively reduce subsidies, such as elimination of subsidized interest rates). On the one hand, subsidies or tax relief for increased use of labor must be approached very carefully in countries where public finance is a real bottleneck and the administrative costs of raising taxes are high. On the other hand, taxation of other factors by increasing costs of production may have deleterious effects on the growth of private sector output. Furthermore, a high elasticity of output with respect to taxes on non-labor inputs combined with a low elasticity of substitution between labor and other factors can reduce both the growth of output and the growth of employment even though the average labor intensity of production is increased.

Increased labor intensity on government construction projects can greatly increase the money costs of the project as is well illustrated by the example of the Thika Road project in Kenya. As is the case with subsidies to the private sector, attempts to increase labor intensity in the government sector must be viewed in light of the constraints on public finance.

Finally, attempts to increase labor intensity of output can have little effect in countries where 60 to 80 per cent of the urban labor force is in the services sector (See Doctor and Gallis (1966)). While one can conceivably increase labor intensity in mining, manufacturing, public utilities and construction, this still leaves a large part of the labor force in sectors which are highly labor intensive already.

Policies which operate on the supply side alone are more likely to be effective than those which influence demand alone. Policies for rural development are crucial in this regard. Eicher et al (1970), in their carefully documented analysis of employment prospects in African agriculture, conclude that "Africa's smallholder land tenure system is remarkably labor-absorbtive provided incentives are available at the farm level (p. 57)." They suggest that increased labor absorption can be greatly stimulated if efforts are made by African governments to avoid "pre-

mature tractor mechanization, anti-export agricultural policies, autarkic food policies,... and over-emphasis on government direct production schemes (in agriculture) which are capital intensive (p. 56)." In government sponsored smallholder settlement schemes, on the other hand, Van Arkadie (1967) notes that "evidence provided by the Farm Economics Survey Unit of the Ministry of Economic Planning and Development (Kenya) suggests employment possibilities in small scale settlement farming are much greater than originally evisioned.... Even with net incomes below £100 per annum, the farmer may be an employer for a substantial part of the year." (See also McArthur (1967).). Van Arkadie (1967) also points out that there has been substantial indirect rural employment generated by the Kenya settlement schemes - petty trade, dressmaking, shoe repair, etc. - which have provided substantial employment opportunities in the small towns in and near the settlement areas.

Another major policy tool which can be used to induce fewer people to migrate to the towns is changes in the balance of government expenditures for social and economic overheads between rural and urban areas. The allocation of funds between main road and feeder road construction is especially crucial. In the past, the bulk of road building expenditures in most African countries has gone for main roads whose construction and improvement greatly facilitate the movement from the rural to the urban areas, while feeder road construction which improves the ability of small farmers to transport their produce to small trading centers and buying stations has suffered from relative neglect.

Finally, population control offers a longer run possibility for attenuating the flow from the rural to the urban areas. Population growth in Africa is so rapid that the problem of landlessness, especially in areas which are already quite crowded, will become considerably exacerbated unless efforts are made <u>now</u> to implement birth control programs. There is considerable evidence (see Eicher <u>et al</u> (1970)) that given time, birth control programs in rural areas can be effective.

VII. CONCLUSIONS

The policies most likely to be effective in ameliorating the problem of unemployment are urban wage restraint, attempts to increase rural labor in ways which generate rural employment, provision of relatively more social and economic overheads in the rural areas, and (in the long run) population control. Attempting to force or induce employers to increase labor absorption by means other than wage restraint are likely to be costly for the government, deleterious to growth, and relatively ineffective. Forced repatriation of urban workers to their rural homes may be partially effective, but runs grave political risks in generating extreme dissatisfaction among those who are repatriated. Rural works programs, either on a voluntary basis or through conscription into Youth Crops or Army works battalions, are likely to be very costly if done on a large enough scale to be really effective. Works programs are likely to be feasible only if accompanied by large doses of foreign assistance to underwrite the food costs of the programs.

Even if one is very optimistic about the efficacy of policies to combat urban unemployment, it is still likely that the number of urban unemployed will increase in the next decade or so, as is shown by the careful projections of the growth of employment opportunities under the most sanguine of assumptions by Frank (1967) and Norbye (1967). Thus,most African countries are faced with the prospects of weathering the storm for some time to come.

The real issues raised by the problem of urban unemployment are political in nature. How does a country maintain a stable and purposeful government structure in the face of a growing number of disenfranchised urban unemployed? How is it possible to countervail the political pressures of the urban elite (i.e., the employed workers) for increased real wages? Can the urban base of African political parties be shifted to the rural areas so that pressures build up for rural development and provisions of social and economic overheads in the rural areas? How

can political leaders overcome the deep prejudices against birth control stemming from traditional attitudes, the influence of the Catholic church, and nationalist pretensions ? These questions must be answered if there is to be any hope of implementing the economic policies suggested in this paper.

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GROWTH WITH UNEMPLOYMENT IN LATIN AMERICA: SOME IMPLICATIONS FOR ASIA

Ralph H. Hofmeister

I. Introduction
II. Demographic Patterns
III. The Evolving Structure of Employment
IV. Unemployment and Underemployment
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I. INTRODUCTION

In Latin America, self-conscious import-substituting industrialization began in the 1930's, and increased rapidly after World War II. Until the last decade employment creation received little attention; there was confidence that industrialization would yield rapid growth in both output and employment.

Unemployment and underemployment are currently very serious in most of Latin America. After about one generation of intensive effort in industrialization, the fraction of the labor force unemployed is probably greater than in the beginning. The absolute number of very poor people has increased.

This paper reviews the recent history and present situation regarding the labor force, employment, and unemployment, and then addresses the policy issues which seem to be most important in this context. Finally, the relevance of the Latin American experience and prospects for Asia are reviewed briefly.

No direct attention is given to foreign trade and economic integration in the following. Certainly more trade and specialization in production in both Latin America and Asia would be helpful and should be a part of the structural changes which are urged. But the effects of plausible increases in trade seem to be secondary to the structural issues which are discussed.

II. DEMOGRAPHIC PATTERNS

For Latin America as a whole, the transition to a sharply higher growth rate of population came about in 1950. For the preceding three decades, the Latin American population grew fairly steadily at a rate of about 22 per cent per decade, or 2 per cent per annum. This growth rate, already high by historical standards, increased to 2.8 per cent per year in the decade of the fifties and to about 3.0 per cent in the sixties.1/ Temperate South America (Argentina, Chile, and Uruguay)2/ has substantially lower birth rates and its population growth has been about 1.7 per cent annually in the 1960's. The demographic transition is well advanced in this region with low and stable death rates and declining birth rates projected for the coming decades.3/ The remainder of Latin America has consistently high birth rates, with only mild declines in prospect. Bolivia and Peru have lower than average population growth rates due to the fact that death rates have not yet fallen to the levels of the rest of Latin America. For Latin America, other than temperate South America, population growth rates are now about 3.2 per cent per annum and may be expected to remain above 3.0 per cent for at least another decade.4/ Currently, international migration has a minor impact on Latin American population growth; for all countries combined there is a small net outflow.5/

With continued high birth rates and a rapid decline in mortality, especially of infants and children, the proportion of children in the total population is very high in Latin America. Excluding temperate South America, children (0 to 14 years) make up a larger fraction, 43 per cent in 1960, of the Latin American population than in the

1/ See footnotes at the end of article.

less developed regions of the world generally, and the fraction is expected to increase slightly by 1980. The percentage of population which is of working age is correspondingly low (54 in 1960).6/ In temperate South America, the working age population (15 to 64 years) as a fraction of total population is comparable to the proportions in the more developed areas of the world - a slightly larger share of children in the former region is off-set by a reduction in those 65 or older.7/

With the expected lag, the growth of the Latin American labor force has accelerated. Until 1950, both the population and labor force grew at about 2 per cent annually. During the 1950's, while population growth increased sharply, the labor force growth rate increased only slightly to 2.1 per cent. But the increased number of survivors begins to show in the 1960's with a labor force growth rate of 2.6 per cent per annum.8/ Given the population growth trends reviewed above and the already low labor force participation rates, the labor force will grow more rapidly in the coming decades; one projection is 2.8 per cent annually in the seventies.9/ Outside temperate South America, the growth is faster, corresponding to the differentials in population growth rates.

Latin America is rapidly becoming an urbanized region. Temperate South America already has a fraction of its population residing in urban areas comparable to that of northwest Europe. The remainder of Latin America is at a medium level of urbanization, and, as is shown in Table 1, has an urban population growth rate about one and one-half times that of temperate South America. More recent data on urbanization will be available from the 1970 censuses, but present evidence suggests that the trends for the 1950's shown in Table 1 have continued in the 1960's; perhaps the urban growth rate has been even higher in the latter decade.10/ In urban areas of 20,000 or more inhabitants, individual countries registered substantially higher annual growth rates from 1950 to 1960: 8 to 9 per cent in the Dominican Republic, Honduras, and Venezuela; 6.5 per cent in Brazil and Ecuador; 5 to 6 per cent in Chile, Mexico, Panama and Peru.11/

TABLE 1

URBAN AND RURAL POPULATIONS IN LATIN AMERICA

	Per cent urban of total population		Per cent increase per year, 1950-1960		
	1950	1960	Urban	Rural	Total
Latin America	41	49	4.5	1.3	2.8
Tropical South America	38	46	5.0	1.4	2.9
Middle America, Mainland and Caribbean	35	43	4.9	1.4	2.7
Temperate South America	59	67	3.3	0.0	2.0

Source: Calculated from Tables 21 and 22, pp. 134, 135 of U.N. 1969.

The crude rates of natural increase of population are reported to be approximately equal in the rural and urban areas of Latin America; the effects of different age compositions are off-set by differing specific fertility and mortality rates.12 In temperate South America rural-urban migration has off-set fully the natural increase in the rural areas; in the rest of Latin America, about one-half of the natural increase of the rural population is migrating to urban areas. Extrapolating these trends, the rural population and rural emigration in temperate South America may remain approximately constant. In other regions of Latin America, rural population and urban immigration will increase for the foreseeable future; the absolute growth of urban areas will accelerate even though the percentage growth rates may decline somewhat as urban populations increase relative to rural.

III. THE EVOLVING STRUCTURE OF EMPLOYMENT

The historical shift in Latin America away from agricultural employment is shown in Table 2. Again, two distinct regions lie behind the aggregate data. As is evident from Table 3, temperate South America is much more industrialized than the remainder of Latin America.13/ The employment

structure among the other regions is similar, and these regions, having about five-sixths of the labor force of Latin America, dominate the aggregated data. Here, more than one-half of the labor force was occupied in agriculture in 1960 and less than one-fifth was in the industrial sector.

According to Table 2b, employment in the industrial sector has been growing at a slowly accelerating rate, the rate for 1950-1960 being 33 per cent for the decade, or 2.9 per cent per year. Similarly, the growth rate in manufacturing reached 29 per cent for the same decade (2.6 per cent annually). Another source yields 28 per cent for 1950-1960 for "industrial employment" which consists of "factory industry" and "artisan industry".14/ Other sources suggest a substantially lower growth rate of 22 per cent for the decade in manufacturing.15/

TABLE 2

EMPLOYMENT BY BROAD SECTORS

a. Percentage Shares of Employment

	1920	1930	1950	1960
Agriculture	65.9	63.4	54.1	50.1
Industry	15.3	16.1	18.6	20.0
Manufacturing	13.0	13.4	13.8	14.5
Construction	1.2	1.5	3.6	4.4
Services	18.6	20.5	27.3	30.0

b. Employment Growth Rates by Sectors

	Per Cent per decade		
	1920-30	1930-50	1950-60
Agriculture	19	11	14
Industry	26	30	33
Manufacturing	24	23	29
Construction	50	83	55
Services	33	39	35
Labor force	22	21	23
Population	21	22	30

Source: Bairoch and Limbor, 1968, Table VI, p.326, and Appendix I, Table F, p.332. The data for 1920 and 1930 are subject to a fairly wide margin of error according to the source.

TABLE 3

SECTORIAL DISTRIBUTION OF EMPLOYMENT
BY GEOGRAPHIC REGIONS, 1960

	Total Labor Force, Millions	Percentage Distribution by Sector		
		Agriculture	Industry	Services
Latin America, total	71	48	20	32
Middle America, Mainland	15	56	18	26
Caribbean	8	53	18	29
Tropical South America	37	52	17	31
Temperate South America	12	25	33	42

Source: Baum, 1967, Table I, p.98.

These differences illustrate the difficulty of obtaining confident estimates of levels and trends in manufacturing employment. Similar discrepancies exist in the data for employment in the artisan or small-scale subsector. The artisan subsector is substantial, its employment exceeding that of the factory subsector in 1955.16/ From 1950 to 1960, the respective growth rates of factory and artisan employment were 39 and 17 per cent, or 32 and 12 per cent, depending on the source.17/ By either estimate, artisan employment increased, but less rapidly than either factory employment or total labor increase; in this decade artisan employment increased in each of the more industrialized countries of Latin America.18/

Manufacturing output in Latin America is reported to have increased at the rate of 5.7 per cent per annum in the decade 1950-1960.19/ From this, the implied annual increase in productivity is 3.0 or 3.6 depending on the alternative employment growth rates. But these aggregate rates hide great differences between countries, and considerable volatility within a country, over time. This is illustrated in Table 4 with output and employment growth rates for selected countries which are the larger contributors to Latin American industrial output. The implied productivity increases over the decade 1953-1963 in Argentina and Brazil are strikingly high.

TABLE 4

GROWTH RATES IN MANUFACTURING OUTPUT AND EMPLOYMENT FOR SELECTED COUNTRIES

	Output per cent per year			Employment, per cent per year		
	1953-58	1958-63	1953-63	1953-58	1958-63	1953-63
Argentina	9.0	-1.2	3.8	0.4	-6.4	-3.0
Brazil	9.7	8.3	9.0	1.0	3.2[a]	1.8[a]
Chile	1.2	6.8	4.0	1.5	2.3	1.9
Colombia	7.4	7.1	7.3	b	b	b
Mexico	10.7	7.4	9.1	b	b	b
Peru	5.1	10.3	7.6	1.9	7.4[a]	2.7[a]
Venezuela	12.7	9.0	10.8	2.1	5.9[c]	b

a. 1958-61 and 1953-61.
b. Not reported.
c. 1961-65

Source: U.N., 1967. Several of the underlying indices do not cover the whole of the manufacturing sector.

There appears to have been no acceleration of manufacturing employment in Latin America during the 1960's. For the first half of the decade, an annual growth rate of 2.1 per cent has been reported;20/ this is approximately the same as the lower estimates for the preceding decade.

Construction, propelled by the combination of industrialization and rapid urbanization, is one of the most dynamic subsectors in Latin America. As shown in Table 2, the growth rate has been high for decades, and in the 1950's growth was 55 per cent for the decade, or 4.5 annually. But even this rate is equaled by current growth rates of the urban labor force.

The service sector is the fastest growing in Latin America, in terms of employment. A 35 per cent growth (3.0 per cent per annum) for the 1950's is shown in Table 2;

alternative estimates place it somewhat higher. The rapid growth of services, or the tertiary sector, has been associated with an industrially maturing economy. But examination of shares and trends of the activities within this sector shows that this is not the case for Latin America generally. The 1960 shares of the labor force and recent growth rates for four activities within the sector are shown in Table 5. The category "unspecified activities" may be largely made up of informal activities of a service nature.

The high rate of employment growth in basic services (utilities, transport and communication, some of which are sometimes grouped in the industrial sector) follows a rapid expansion in output. Whether the employment growth in commerce and finance and in government represents consistently new productive positions is doubtful. There appears to be considerable underemployment in small-scale retailing, and some governments have pursued a conscious policy of increasing employment in the public sector in order to decrease unemployment.

TABLE 5

DISTRIBUTION OF ACTIVITIES WITHIN THE SERVICE SECTOR

	Per cent of Labor Force	Employment growth, per cent per annum	
	1960	1950-60	1960-65
Basic services[a]	5.2	4.3	3.4
Commerce and finance	9.2	3.8	3.8
Government	3.7	3.3	3.7
Miscellaneous services	12.0	4.4	4.2
Unspecified Activities	2.3	1.1	9.4

a. Utilities, transport and communications

Sources: Jones, 1968, Table 1, p.454, and U.N. Economic Commission for Latin America, Economic Survey of Latin America, 1966.

The very rapid increase in employment in miscellaneous services and unspecified activities is ominous, for it suggests an increasing short-fall of productive employment opportunities for the growing labor force. Domestic service and petty trade are examples of the activities in miscellaneous services. 'Unspecified activities' has been described as "mainly overt and disguised unemployment in the form of marginal services."21/ This interpretation is reinforced by the evidence that gross product per worker in these categories declined from 1950 to 1960.22/ Rapid growth in "employment" in these categories suggests that reported data on employment and unemployment should be interpreted carefully.

IV. UNEMPLOYMENT AND UNDEREMPLOYMENT

Unemployment data in Latin America must be interpreted differently from unemployment data in Europe or in the United States. In Latin America most of the labor force has no unemployment insurance or compensation whatsoever. Few can remain long in the ranks of the openly unemployed; for subsistence, many of those unable to find normal employment undertake a variety of occupations of very low productivity. Subsistence cultivation, street vending, and shoe shining are representative of the means of coverting open unemployment to underemployment and disguised unemployment. Thus, the standard definition of unemployment, 'without employment and actively seeking a job', is a gross understatement of the underutilization of human resources, especially so in rural areas.

Measurement of unemployment in Latin America is severely handicapped by the limited surveys which are made. For only six of the twenty-two countries are data on unemployment published regularly: Argentina, Chile, Colombia, Costa Rica, Panama, and Trinidad and Tobago.23/ None of the surveys have been continued long enough for confident judgements regarding historical trends. Many of the surveys have been done by university research groups with limited financial resources, and most of the surveys are confined to urban areas.

The technical difficulties are severe in unemployment surveys in Latin America. Normally, a population census constitutes the base from which a survey sample is drawn.

TABLE 6

RECENT URBAN UNEMPLOYMENT RATES

Argentina, April 1968	
Greater Buenos Aires	5.4
Cordoba	7.4
Tucuman	11.0
Bolivia, December 1966	
Cochabamba	17.8
La Paz	10.5
Oruro	17.3
Potosi	11.9
Santa Cruz	15.2
Sucre	18.1
Tareja	13.7
Chile, 1969	
Concepcion-Talcahuano, April	11.0
Lota-Coronel, April	15.2
Greater Santiago, June	7.1
Colombia, 1967	
Barranquilla	18.4
Bogota	16.0[a]
Bucaramanga	9.8
Cali	14.9
Ibague	13.1
Manizales	17.4
Medellin	14.5
Popayan	10.8
Costa Rica, July 1966 - June 1967	
San Jose metropolitan area	5.6

continued.

Table 6: continued

Panama, 1966	
Panama City	8.4
Peru, April - May 1969	
Lima - Callao	5.2
Trinidad and Tobago, 1967	
Port of Spain	18.0[b]
Venezuela, 1964	
Barquisimeto	16.8
Caracas	13.7
Maracaibo	21.0
San Cristobal	16.2
Valencia	11.8

a. March, 1967. Average of the quarterly surveys in Bogota are: 1963, 7.9; '64, 7.1; '65, 8.9; '66, 10.1; '67, 12.2. The March, 1969 rate was 11.3 per cent.

b. Trinidad and Tobago use a broader definition of unemployment: anyone who is unemployed, available for work, and who looked for work in the previous three months.

Sources: O.A.S., 1969; Jones, 1968; Centro de Estudios sobre Desarrollo Economico, Empleo Y Desempleo en Colombia, Universidad de los Andes, Bogota, 1968.

The people who are underenumerated in a census--e.g., young, unattached males and those without a regular abode--are exactly those most likely to be unemployed. Also, it is very difficult to adequately represent the areas of informal settlement, the barrios or shanty-towns, which are growing

rapidly in and around most Latin American cities.24/

Thus, sample surveys are likely to understate the actual number of unemployed, but to an unknown extent. Also, the apparent increase in unemployment rates from earlier surveys may be partly due to improved sampling procedures. Recent unemployment rates for a number of Latin American cities are given in Table 6. Rates of 15 per cent and higher are common; country-wide rates are believed to be lower because open unemployment is expected to be less in the rural areas. However, the survey problems are formidable in the rural areas, and few have been undertaken. In Chile, in 1967, a national household sample survey yielded an unemployment rate of 5.1 per cent while rates for the three urban areas surveyed in an independent survey were 6.1, 12.8, and 11.0 per cent.25/

A substantial amount of unemployment in Latin America is hidden by non-entry or withdrawal from the active labor force. Only one-third of the population is economically active, the smallest share for any continent.26/ Part of this low participation rate is due to a relatively small share of the population in the working ages. Activity rates, specific for age and sex, are low by international comparison. The activity rate for males under age 25 is low and declining;27/ the participation rate for women is among the lowest in the world.28/ Despite much lower school attendance, males aged 15-19 in Latin America have a slightly lower activity rate than the same cohort in the industrialized countries. Latin American women have participation rates of one-half for ages 15-24, and two-thirds for ages 25-64, of the comparable rates in the industrialized countries.29/ Explanations for these low activity rates which have been put forward—school enrollments of youths, the high fraction of young children in the population with the attendant needs for mothers to stay in their homes, —are not convincing. "However, a number of studies indicate that participation rates in developing as well as developed countries fluctuate with the state of demand for labor, and that low levels of demand deter many from entering the labor force and induce others to drop out of it."30/

Taken together, non-participation due to the lack of employment opportunities and involuntary part-time employment (measured in full-time equivalents) appears to be comparable in magnitude to open unemployment. In a 1968 survey in three metropolitan areas in Chile, adding those wanting to work full-time or part-time, but no longer actively seeking work, and the involuntary part-time workers (part-time hours were converted to full-time equivalents) amounted to effective unemployment rates of 12.5, 18.3, and 19.3 per cent. At the same time the unemployment rates according to the standard definition were 5.6, 10.9 and 15.3 per cent in the respective cities.31/ These estimates omit hidden underemployment in agriculture and services, the sectors where one would expect underemployment to be the highest. In the Lima-Callao area of Peru, adding the persons working fewer hours than normal, but desiring to work longer, resulted in an increase of 6.1 per cent in the unemployment rate.32/

A possible criterion of underemployment is the level of income earned: even if a person works a normal full-time number of hours he is considered to be underemployed if his income is below a specified level. A survey in the Lima, Peru, area found about 20 per cent of the economically active population to be underemployed by this definition.33/ This concept of underemployment poses difficulties; the cut-off level of income is determined arbitrarily. A "low" real wage in Latin America would be a medium wage in Asia. Alternatively, the low wage may represent the low productive capacity of the worker due to lack of skills and training or to an inadequate diet.

However, a concept of underemployment despite "full-time" work should not be dismissed. The very high fractions of the labor force in Latin America classified as self-employed and unpaid family workers--above one-half in some cases34/ --suggests a kind of "self-help unemployment relief." If a person has qualifications comparable to those of workers holding jobs which pay substantially more, he is clearly underemployed. While measurement is difficult, there appears to be substantial underemployment by this definition in Latin America, and it is not confined to the lowest paid workers.

Two recent studies "attempt to determine the total 'unemployment equivalent' of persons who are openly unemployed, those who are able to work part-time or less than the normal work period, and those who are employed in an economic unit operating at exceptionally low productivity levels"35/ By these criteria, underemployment in 1960 in Latin America was equivalent to full-time unemployment of more than one-quarter of the labor force; Table 7 shows the results by several sectors and by countries grouped according to their stage of industrial development. The very high rates, 44.2 and 50.2 per cent, for agriculture in groups II and III are not surprising in view of the extent of very small land-holdings. The high rate in manufacturing in group III, 40.4 per cent, may reflect the scale of artisan relative to factory manufacturing.

TABLE 7

UNEMPLOYMENT EQUIVALENT BY GROUPS OF COUNTRIES, 1960

	Per Cent Unemployment			
	Country Groups[a]			All Latin
	I	II	III	America
Agriculture, forestry, hunting, and fishing	24.1	44.2	50.2	32.6
Manufacturing	13.7	13.5	40.4	16.7
Other[b]	22.9	23.3	23.8	23.0
All sectors combined	22.0	30.4	42.4	26.7

a. The groupings reflect the relative extent of industrialization, beginning with the most developed. I: Argentina, Brazil, and Mexico; II: Chile, Colombia, Peru, Uruguay, and Venezuela; III: Bolivia, Central America, Dominican Republic, Ecuador, Haiti, Panama, and Paraguay.

b. About three-quarters of the unemployment in this category is in the service sector.

Source: O.A.S., 1969, Table 6, p.13; the original source is ILPES-CELADE, Elementos para la elaboracion de una politica de desarrollo con integracion para America

Table 7: continued

Latina, Santiago, Julio 1968. Several apparent errors have been changed to obtain internal consistency in the source table.

Whether the exactitude of these estimates can be defended is immaterial. The broad picture, grim as it is, is clear. In many cities the open unemployment rates are in the range of 10-15 per cent; higher rates are common. Disguised unemployment via non-participation in the labor force adds 5 per cent or more. If open unemployment is less in the rural areas, pervasive underemployment may yield an equivalent unemployment rate higher than in the cities. Taking together open and hidden unemployment and underemployment, the equivalent of unemployment of one-quarter of the labor force is highly probable. And this is a chronic rate, persisting in the face of moderate growth rates for the Latin American economies. Any economic stagnation, or substantial slow-down in growth, will increase unemployment sharply. If there is any change in the most recent years, it is in the direction of higher rates of unemployment and underemployment.

V. POLICY ISSUES

In brief, the fundamental fact for employment policy in Latin America is that employment has not adjusted to the demographic situation. Outside temperate South America, there is no near prospect of declining population growth rates, and labor force growth rates are now approaching the population growth rates. As of 1960, before labor force growth rates had accelerated substantially, unemployment and underemployment were endemic at levels which represented a large wastage of human resources and potential for social instability. Since that time it appears that productive employment has increased at about the same growth rate as in previous decades, and that the increased growth rate of the labor force is being diverted into greater underemployment and unemployment. In other words, the economic structure in Latin America can accomodate a labor force growth rate of 2 per cent annually, but no substantial progress has been made towards the capacity to usefully absorb the near 3 per cent which will persist for decades.

In the past, attention has been concentrated on aggregate growth as the remedy for unemployment. However, if the existing structure persists, there is no realistic hope for sufficiently high aggregate growth rates to meet the labor force growth. From 1960 to 1968 the output of total goods and services in Latin America increased by 4.7 per cent annually. With recent levels of productivity increase, this would have accomodated a labor force growth rate of about one-half that actually experienced.36/ A large increase in the growth rate of output along the existing structural lines would place impossible requirements on savings and foreign resources. In addition, it is doubtful whether an effective demand would exist for the magnitude of total output which would employ the growing labor force.

Hence, substantial structural changes appear to be necessary if present trends in unemployment and underemployment are to be reversed. The most important areas for new policy directions are agriculture, urbanization, and product mix and factor proportions in industry. A fundamental question is whether employment creation is competitive with sustained can handicap growth. Policies which are essentially palliative for unemployment are likely to divert financial and administrative resources from more productive uses. Over-staffing of government agencies and public enterprises can reduce the level of performance of these units; a common example of this in Latin America is the state railways. Make-work or relief types of undertakings typically have low efficiency structural changes which contribute to increases in both employment and output, policies must lead to an efficient employment of all resources, human and material, within the area of application, and the policies in various sectors must be mutually consistent.

Latin American agriculture is the most obvious sector for structural change. Excepting islands in the Caribbean and several small countries, that is for most of the population, Latin America does not have population pressure on the land. Arising from the colonial period, perpetuated through inertia and vested economic and political interests, and defended by myths of the economic inefficiency of land reform and parcelization, the "concentration of land in the hands of a

few large landholders is a characteristic of the Latin American situation."37/ These large holdings are typically held by an absentee landlord who employs a manager of limited ability and motivation, and who utilizes the land extensively so as to minimize the managerial requirements. Influenced by the proximate example of North American agricultural technology, "modern agriculture" tends to be associated with medium or large scale units and labor-saving mechanization. In examples such as northern Mexico, the Cauca and Magdalena valleys of Colombia, and irrigated coastal plains in Peru, a distinctively Latin American approach to agricultural transformation is recognizable. Neglecting a large pool of labor, this mechanized approach is consistent with the concentration of land ownership, and is encouraged by government policies in credit and exchange rates for imported equipment which lower the private costs of mechanization substantially below the social costs.

With the exception of a few countries, land reform and parcelization has been largely a token effort in Latin America. A popular opinion has held that land parcelization is economically inefficient in that it supposedly leads to declines in production and freezes agriculture in a backward technology. A recent survey of the empirical evidence concludes that such is not necessarily the case. "It has been shown that small farmers will rapidly adopt profitable new technology, and that in a number of cases land reform has been associated with substantial increases in output. A modest amount of appropriate planning and project management can overcome most (of the) production-decreasing factors associated with land reform activities."38/

Far-reaching land reform would immediately increase employment opportunities in agriculture. With the present extensive use of much of the potentially most productive land, it could lead to sharp increases in production. A rapid growth in agricultural output is a necessary condition for a substantial increase in employment because of the relatively high income elasticity of demand for foodstuffs on the part of the unemployed and underemployed. Higher incomes in the rural sector would increase the demand for the more labor-intensive industrial products--e.g., textiles, clothing, and shoes--of which the

output is now growing slowly due to lack of demand. Of perhaps the most significance for sustained economic growth, higher and more egalitarian incomes in the rural sector are essential for more adequate educational opportunities for rural children.39/ Also, higher rural incomes may be a prerequisite for reducing rural birth rates.

Rapid urbanization in Latin America has not been encouraged by direct public policy, but by default in the lack of viable development policies in the rural sector. However, explicit policies favouring rural-urban migration have been favoured by several development economists; the most outspoken recommendation for Latin America is that of Currie.40/ Space does not permit a detailed discussion of the argument.41/ In brief, for lack of a realistic quantitative analysis of the number of people involved, the capacity of the industrial sector to absorb labor productively, and the required savings and foreign resources, Currie and others mistake the result of a successful development effort for the means. Simply because rapid economic development for several generations would result in a largely urbanized work force, it does not follow that the best path for development is to urbanize as rapidly as possible. On the contrary, the urban unemployment and social and political tension already existing suggest that premature urbanization may be a dead-end street.

Regarding policies in manufacturing which affect employment, most of the attention has been focused on the proportions of capital and labor inputs. Here we can only summarize the issues. First, a considerable number of public policies bias the prices of equipment and wages, and affect the availability of key inputs, so that private decisions based on profit-maximizing or cost-saving motivations will not be consistent with the relative social opportunity costs of the inputs. The most pervasive group of policies is that designed to reduce the cost of, and to encourage investment in, plant and equipment. Included are: over-valued foreign exchange rates and minimal duties to reduce the local cost of imported equipment; subsidized loans, even to the point of negative real interest rates, to finance capital investment; special tax concessions which lower the effective cost of fixed capital; discouragement

or outright prohibition of importation of used equipment; and linking of import permits for raw materials and intermediate products with capital investment. On the other hand, various public policies raise the effective wage rates: high, relative to competitive wage levels in the country, minimum wages; required bonuses and generous retirement pensions; and heavy social security taxes on wages.

The impacts of these policies are multiplicative, and they all operate to lower the effective price of plant and equipment relative to wages. A series of these interventions combined, each biasing the price moderately, can alter the price ratio by several hundred per cent. The motivation for subsidizing capital seems to be the following: labor is unemployed for lack of the complementary capital; hence, encouragement of capital investment will generate employment. This would follow if labor and equipment could be used only in fixed proportions. The extent of substitutability between labor and equipment is debated; present evidence suggests that at least in some production processes a fair degree of substitution is possible, subsidization of capital and penalties on wages encourage the replacement of labor by labor-saving equipment. Hence, less governmental intervention might increase both economic efficiency and employment.

A second question in the factor proportions issue is the extent to which socially efficient combinations would require private investments on which the return could not be privately appropriated. Examples are: research and development investments for equipment designs which would be appropriate for the factor availabilities in the country; and investments in training workers to use the more labor-intensive technology. In some cases public investments may be well-justified to facilitate a less capital-intensive technique. Ironically, some public investments in this area may have just the opposite of the needed effect. For example, a more labor-intensive technique may require a moderate degree of training for a large number of operators, while the more

capital-intensive needs a small number of highly trained technicians. (This is the case for alternative spinning and weaving techniques.) Government subsidization (and international assistance) is much more likely for the latter training than the former.

Finally, various non-economic motivations for using a capital-intensive technique are frequently cited. For example: managerial ignorance, inexperience, or inertia; a desire to be "modern" or for the prestige associated with a more "advanced" technology. The charge of a new "technological imperialism" has been made. The cultural fixation of the imported technical advisor is not to be underestimated. However, some of these non-economic preferences might be less indulged if the private cost of so doing were increased.

The implications of the output mix for employment in manufacturing receive less attention than is justified. A large part of the import-substituting industrialization in Latin America, since World War II, has produced for the economic elite. Frequently, products identical with the formerly imported ones are produced under license with the original supplier. This encourages the adoption of the production techniques of the more advanced country. The elite market is necessarily narrow and frequently prevents the achievement of scale economies in production. Further, the experience of several Latin American countries suggests slow growth of the market after the initial import replacement phase. To maintain the momentum of industrial growth, the industrially more advanced of the Latin American countries are moving to earlier stages in industrial policy with the production of machines and equipment, iron and steel, chemicals etc. These products tend to capital-intensive production and to require wider markets than those existing within Latin American countries to achieve economies of scale. Meanwhile the more traditional and more labor-intensive lines of production grow slowly for lack of demand.42/ Faster employment creation in both rural and urban areas would expand the mass market more rapidly.

The potential market for equipment for an efficient but labor-intensive agricultural sector has not yet been touched in Latin America. Here there is an evident complementarity between structural change in agriculture and industrial

development. The Japanese means to farm mechanization is more relevant for much of Latin America than is the North American model. The former is much more consistent with labor-intensive, de-centralized manufacture of equipment than is the latter.

Another complementarity between industry and agriculture is the provision of industrial raw materials such as fibers and vegetable oils. In both agricultural production and industrial processing substantial employment creation is possible. And, the supply creates a part of its own demand because the final products are mass consumption items.

In brief, much of the recent economic development of Latin America has consisted of the adoption of a part of the economic structure of the more developed countries. This is seen in both production techniques and the market orientation of the products. This adopted structure is not consistent with the actual circumstances of Latin America. The consequences are major underutilization of human resources, serious and increasing unemployment and underemployment, a continuing maldistribution of income, and the attendant social and political instability. The outlines of a structural transformation are visible; the changes would be consistent with both an early improvement in human welfare and a sustained growth in the future.

VI. SOME IMPLICATIONS FOR ASIA

Recognizing that generalizations do great injustice to the diversity of Asia—even within the Near East and South Asia—we will proceed to generalize for the sake of brevity.

First, the growth rates of population and the labor force in Asia are somewhat lower than in Latin America. However, in the large, this is because mortality rates remain higher, not because of progress in reducing the birth rate. The potential exists in some Asian countries for population growth rates approaching current levels in Latin America. The present situation and prospects in Latin America demonstrate the great urgency of population control measures in Asia.

The above is reinforced in view of the fact that the Asian countries are in less favourable circumstances otherwise. Present unemployment and underemployment appears to be of a magnitude comparable to that of Latin America, or more severe. The acceleration of population and labor force growth generally is coming at an earlier stage of development than in Latin America—the fraction of the labor force in agriculture is larger, and the contribution of the industrial sector to total output is less. And the severe pressure on land resources which is exceptional in Latin America is the general situation in Asia.

In some regions of Asia concentration of land ownership presents problems in agriculture comparable to those of Latin America. But more typically in Asia, land is divided into small plots, perhaps unduly subdivided. A faster growth of agricultural production is as necessary a condition for more rapid employment generation in Asia as in Latin America. With already full utilization of agricultural land resources, the recent productivity breakthroughs in Asian agriculture are critical. On technical grounds, the new technology based on fertilizers and high yielding varieties is consistent with a labor-intensive agriculture; high levels of labor inputs per unit of land area may permit fuller exploitation of the yield potential than would mechanized techniques. However, some additional mechanical inputs appear to be essential in most cases. Broadly, there is a choice between the Latin American and the Japanese approaches to agricultural modernization. The former leads to an agricultural dualism in which a commercial and mechanized subsector, along labor-saving lines, is created alongside a traditional peasant subsector. The latter proceeds via integration of peasant agriculture into the market economy and maintains a relatively labor-intensive agriculture, with mechanical inputs which are complementary to a high-yield technology, but which are not aimed at labor replacement.

However, the larger landholders may be motivated to adopt the labor-saving mechanical inputs. (And the advantages accuring to the first adopters—who will tend to be the larger

landowners—of the new technology may lead to land concentration unless active public policies prevent it.) This preference is frequently reinforced by government policies which lower the private price of the labor-replacing machines.43/ The effects of moving to a dualism of a large (relative to the circumstances of population pressure on the land), mechanized, and "modern" subsector beside the traditional would be similar to the results of concentrated land ownership in Latin America. The poor allocation of resources in agriculture would not be conducive to rapid growth in agricultural output. Lack of employment opportunities in agriculture would accentuate rural-urban migration.

In Asia it is even clearer that rural poverty must be attacked primarily within the rural areas. The limited capacity for urban employment creation, the large fraction of the population in the rural areas, the limited education and skills of migrants, and the enormous potential flood of migration rule out urbanization as a major part of the solution to rural poverty.

The above discussion of industrial policy seems to be as applicable to Asia as to Latin America. Again, the example of the industrialized countries has been accepted uncritically. Production techniques and product designs receive limited adaptation for the radically different economic environment. Major emphasis in the industrialization drive has been placed on the replacement of imported consumer goods for the economic elite and of imported capital goods and intermediate products. The output of mass consumer goods grows slowly for lack of adequate demand. Industrial employment absorbs a small fraction of the growth of the urban labor force.

As in Latin America, economic expansion along the lines of the recent past holds little promise for absorbing productively the presently unemployed and future additions to the labor force. Structural changes which yield productive employment of all resources, especially human, and which are consistent with sustained growth, will be required.

VII. CONCLUSIONS

It is doubtful whether Latin America, with the possible exception of a few countries, is on a sustainable path of economic development. The shortcomings of the existing economic structure are most evident in growing unemployment and underemployment.

In broad terms, Asia is on the same path as, and a little behind, Latin America. The existing direction appears to be even less feasible for Asia than for Latin America. In both countinents, fundamental structural change is necessary. In this writer's opinion, there is no doubt that the change will take place; the relevant questions seem to be when, how rapidly, and under what political circumstances.

With appropriate structural change, the immediate goals of productive employment and improvements in human welfare may be consistent with sustained economic growth. Research on these issues has hardly begun, but is of the highest priority.

FOOTNOTES

1/ Even for recent decades, differing growth rates are given or implied in various sources. The rates for 1920-1950 are calculated from Bairoch and Limbor, 1968, Appendix I, Table F, p.332. This source yields 2.7% for 1950-1960; 2.8% is reported in Jones, 1968, p.451; recent data from the U.N., 1969, Table 21, p.134, imply 2.8%. For the 1960's Jones, 1968, p.451, gives 2.9%; U.N., 1969, Tables 5 and 6, pp. 29, 30 implies a growth rate in excess of 3.0%.

2/ U.N. regional divisions are used throughout this paper; for the countries in the several Latin American regions see the Demographic Yearbook.

3/ Estimated and projected birth and death rates for temperate South America, 1950-2000, are reported in U.N., 1969, Tables 5 and 6, pp.29, 30.

4/ From U.N., 1969, Tables 5 and 6, pp.29, 30, growth rates (per cent per year) are 2.9 for 1950-60, 3.2 for 1960-70, 3.1 for 1970-80, and 2.8 for 1980-2000.

5/ U.N., 1969, p.37.

6/ U.N., 1969, Table 8, p.34.

7/ Ibid. As of 1960, 63 per cent of the population is estimated to be of age 15 to 64 in both temperate S.A. and the more developed areas.

8/ Derived from Bairoch and Limbor, 1968, Appendix I, Table F, p.332, and Jones, 1968, p.452.

9/ Thirty-two per cent for the decade: from ILO, The World Employment Program, 1969, p.21, quoted in O.A.S., 1969, p.19.

10/ Jones, 1968, p.455.

11/ U.N., 1965, p.12.

12/ U.N., 1969, p.40.

13/ The sectorial division for Latin America as a whole in Table 3 differs somewhat from the 1960 distribution of Table 2. Apart from rounding errors, the discrepancy could arise from differing allocations of the "unspecified activities" and from alternative adjustments to the crude census data. Both subsistence farmers and marginal service workers are undercounted in a census.

14/ Calculated from U.N., 1966, Table I-16, p.16.

15/ Implied in Jones, 1968, Table I, p.454, after correcting the printed 15.5 (Manufacturing, 1950) to 14.5 which is consistent with the remainder of the column. His source is an I.L.O. document. For a longer period, 1948-1961, a rate of 2.0 per cent annually (equals 22 per cent per decade) is reported by Dziadek, 1967, from U.N., The Growth of World Industry: International Analyses and Tables, 1938-1961.

16/ U.N., 1966, Tables I-17, I-18, pp. 17, 18.

17/ The higher from U.N., 1966, Tables I-17, I-18, the lower implied in Jones, 1968, Table I, p.454.

18/ U.N., 1966, Table I-18, p.18.

19/ Dziadek, 1967, quoting U.N., The Growth of World Industry: International Analyses and Tables, 1938-1961.

20/ U.N., Economic Commission for Latin America, Economic Survey of Latin America, 1966.

21/ Ibid., p.31.

22/ Jones, 1968, Table I, p.454.

23/ O.A.S., 1969, p.2. Costa Rica and Panama are small countries, and the country Trinidad and Tobago consists of two tiny islands in the Caribbean.

24/ The effects of survey design are illustrated in two surveys in March, 1967, in the Santiago, Chile, metropolitan area: with the sample which had been used in previous surveys the employment rate was 5.5 per cent; with a new sample the measured rate was 6.3 per cent. (Instituto de Economia y Planificacion, Universidad de Chile).

25/ The urban areas were greater Santiago, Lota-Coronel, and Concepcion-Talcahuano, and were surveyed by the Instituto de Economia y Planificacion, Universidad de Chile. The nationwide survey was done by the Centro de Estudios Estadistico-Mathematicos, Universidad de Chile.

26/ Jones, 1968, p.452.

27/ Ibid. The activity or participation, rate for any cohort is the proportion of that group which is working or looking for work.

28/ O.A.S., 1969, p.3, and Table 2, p.5.

29/ Ibid., Table 2, p.5.

30/ Ibid., p.3.

31/ Surveys by the Instituto de Economia y Planificacion, Universidad de Chile. The cities are greater Santiago, Concepcion-Talcahuano, and Lota-Coronel.

32/ O.A.S., 1969, p.8. The year was 1967; compare the reported unemployment rate of 5.2 in 1969 from Table 6. The cited source is not specific whether the hours are converted to full-time equivalents.

33/ O.A.S., pp.9, 10, Table 4.

34/ O.A.S., p.6.

35/ O.A.S., 1969, p.11. The studies are ILPES-CELADE, Elementos para la elaboracion de una politica de desarrollo con integracion para America Latina, Santiago, 1968, and U.N., Economic Commission for Latin America, Second United Nations Development Decade--The Trade and Domestic Savings Gaps and Structural Unemployment in Latin America, Santiago, 1969, (E/CN. 12/831).

36/ O.A.S., 1969, pp.14, 15.

37/ Sternberg, 1967, p.8; see his Tables II and III.

38/ Adams, 1969, p.27.

39/ Thiesenhusen, 1969, argues this strongly, and compares land tenure and investment in human capital in Latin America with the rural south of the U.S.A.

40/ Lauchlin Currie, Accelerating Development. (New York: McGraw Hill, 1966).

41/ An excellent brief discussion is in Adams, 1969, pp.15-23. Thiesenhusen, 1969, comes to a similar conclusion that rural poverty must be resolved largely within the rural sector.

42/ O.A.S., 1969, p.15, quoting Economic Commission for Latin America, Second United Nations Development Decade--The Trade and Domestic Savings Gaps and Structural Unemployment in Latin America, (E/CN.12/831), Santiago, 1969.

43/ Compare the excellent discussion of these issues in Cownie and Johnston, American Economic Review, September, 1969, pp.569-582.

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EMPLOYMENT AND UNEMPLOYMENT IN PUERTO RICO 1940-1970

Lloyd G. Reynolds

I. Economic Growth in Puerto Rico
II. Labor Force, Employment, Unemployment
III. The Behaviour of Manufacturing Employment
IV. Conclusion
V. Statistical Appendix

I. ECONOMIC GROWTH IN PUERTO RICO

Puerto Rico is a small, island economy, with a population of less than 3 million. It is a very open economy, with exports amounting to about half the GNP. The most important exports are manufactured goods and tourist services, though sugar, rum, and other traditional exports are still substantial.

Puerto Rico has the status of a "free and associated Commonwealth", operating within the United States tariff and immigration system. There is no legal barrier to movement of labor, capital, and commodities between Puerto Rico and the mainland United States. One would, thus, expect a tendency toward equalization of product and factor prices in the two regions. There have in fact been large movements of capital into Puerto Rico and of labor out of Puerto Rico. Wage levels in Puerto Rico and the mainland have, as we shall see, moved closer together, though they are still far from equal. The rate of return on capital remains much higher in Puerto Rico than on the mainland, though the gap is somewhat narrower than it was in 1950. Factor flows are in the right direction, but they are too sluggish to produce more than a very gradual movement toward equal returns. Why this should be is a very interesting question, but this question is not central to our present concern.

While Puerto Rico is in many ways a part of the mainland economy, it is not subject to United States taxation on either corporate or personal incomes. The exemption from federal profit taxation permits use of tax holidays as an incentive to industrial investment. Lower tax rates on personal incomes provide an incentive for investors, executives, and others to settle in the Island. This situation - all the benefits of integration with the mainland economy but with few of the costs - is very advantageous to Puerto Rico; and the voters there have shown little inclination to exchange it either for complete independence or for the status of an American state.

The Puerto Rican case is thus rather peculiar and not necessarily typical of other developing countries. It is nevertheless an interesting case. The rate of economic growth, and particularly the growth of manufacturing output, has been very high. But despite this fact unemployment remains in the range of 10 to 15 per cent of the labor force, with only a slight downward trend. This apparent paradox requires explanation. The Puerto Rican case is also unusually well documented. The statistical systems have been developed in consultation with Washington, and economic measurements have nearly the same degree of precision as corresponding measurements on the mainland.

The rate of progress since 1940 may be suggested by a few figures. GNP, in constant 1954 dollars has increased from $499 million in 1940 to $2,323 million in 1967. This is a compound rate of 6 per cent per year. Moreover, while there have been year-to-year fluctuations, the decade growth rates are almost identical for the 'forties, 'fifties, and 'sixties. Over the same period real GNP per capita increased from $269 to $850, which might be regarded as removing Puerto Rico from the category of the less developed countries. Manufacturing output, in current dollars, rose from $27 million in 1940 and $89 million in 1950 to $678 million in 1967 - a rate of increase which must be almost unprecedented in the world. We cannot here enter into a detailed

explanation of these high growth rates, 1/ though I will try to answer any specific questions during the discussion period.

This rapid growth of total product has been accompanied, as would be expected, by substantial changes in the composition of output. Table 1 shows the distribution of net income by sector of origin for selected years since 1940. The trends have been much as one would expect from studies of long-term growth by Kuznets and others. Agriculture's share of output has fallen greatly, from about 32 per cent in 1940 to 7 per cent in 1967. The relative importance of manufacturing has doubled, from 12 per cent to 24 per cent. The balance between agriculture and manufacturing is now rather close to that for the Continental United States. Construction has expanded very rapidly, from 1.3 per cent of national output in 1940 to 8.5 per cent in 1967. This is due to a high volume of modern residential construction in urban areas and extensive hotel construction for the tourist trade, as well as the large amount of industrial and commercial building. Trade and government have increased their weight in national output by something like 50 per cent; and other service activities have expanded moderately despite a sharp decline in domestic service.

The industrial distribution of employment, shown in Table 2, is characteristically different from the distribution of output, because of inter-sectoral differences in output per worker. We shall have more to say about this Table when we come to examine the detailed behaviour of employment.

II. LABOR FORCE, EMPLOYMENT, AND UNEMPLOYMENT

The principal determinant of labor force size is of course the rate of population increase. In periods when the rate of natural increase is not changing markedly, one can ignore the lag between birth and entrance into the labor force, and take the population growth rate and the labor force growth rate as identical. The labor force participation rates of various age - and sex - groups may also change, but such changes are usually so gradual that they do not

1/ For a more detailed analysis, see Lloyd G. Reynolds and Peter Gregory, Wages, Productivity, and Industrialization in Puerto Rico. Homewood, Ill.: Richard D. Irwin, Inc.1965.

invalidate this rough rule. In the case of Puerto Rico, emigration is also an important labor force determinant, and must be brought explicitly into the picture.

Let L represent labor force, M equal net out-migration, and E and U represent employment and unemployment. Then over any time period, as a first approximation,

$$\Delta U = \Delta L - M - \Delta E$$

Let us look briefly at the behavious of each of the right-hand terms.

The rate of population growth has been declining. The crude birth rate, which in 1950 was still above 40, has now fallen to less than 30, yielding an annual population increase of about 2 per cent. The decline can be attributed partly to the normal effect of urbanization and rising income levels, partly to the fact that most of the migrants to the mainland have been young people in the reproductive years. There has also, however, been a decline in age-specific fertility rates. The network of government - sponsored family planning clinics which has now been operating for about 20 years has probably had some effect, though its size is difficult to establish.

A further favourable factor, from an employment standpoint, is the escape-value of migration to the mainland. During the 1950s, out-migration averaged 43,000 per year, almost equalling the natural increase of population. Moreover, the migrants were mostly young people of labor force age, more than half of them falling in the range of 15 to 29. The result, apparent from Table 4, was that during the 'fifties the Puerto Rican labor force actually fell by about 80,000 people. Out-migration has slackened during the 'sixties, and there is now a substantial return flow of Puerto Ricans to the Island. Even so, the increase of roughly 200,000 in the Island's labor force during the 'sixties is less than half as large as it would have been in the absence of migration.

It will be noted from Table 4 that aggregate employment has roughly paralleled the movement of the labor force,

falling during the 'fifties, and rising substantially during the 'sixties. More interesting is the question of where the new jobs were appearing in the economy. Between 1940 and 1967 there was a net employment increase of 394,000 in the expanding sectors of the economy. The distribution of the increase by sectors is shown in Table 3.

The largest single increase was in government employment. The Commonwealth government has been very active, and effectively active, in promoting industrial investment, in providing economic infrastructure, in developing a modern system of education and medical services, and in building public housing for low-income families. Service activities (including tourism), trade, and manufacturing contributed about equally to the expansion of employment. Note also the large increase in construction jobs. Although manufacturing investment might reasonably be regarded as the spearhead of economic expansion during this period, the increase in employment was not concentrated in this sector but was widely diffused throughout the economy.

Economic development is employment-destroying as well as employment-creating. Domestic service is always an early casualty; and this has certainly been true in Puerto Rico, where housewives' complaints of servant shortages are now as loud as in New York. The home needlework industry was virtually wiped out by the transfer of garment production to factory units. Most of these people, however, were women working part-time in the home, so that the employment reduction in man-hours was smaller than the reduction in numbers.

Much the largest suction of labor was out of agriculture. About half of the decline seems to have come from sugar cultivation, the remainder from other types of farming. Sugar has been a declining industry in Puerto Rico since the early 'fifties. Technical progress has not kept pace with that in other sugar-growing areas, and both output per acre and per worker have stagnated. Meanwhile, wage levels have risen rapidly, and higher production costs, combined with a virtually unchanged sugar price on the mainland, has made sugar growing less and less attractive.

Again, however, the reduction of full-time employment in agriculture has been considerably less than the numbers in Table 3 suggest. Sample surveys in the period 1955-60 indicate that only about half of the drop in numbers attached to agriculture during that period consisted of fully-employed agricultural workers, partly self-employed farmers, partly full-time wage-earners. The other half consisted of people attached to the agricultural sector, but either underemployed or unemployed. To put the point differently, the agricultural labor force of 1970 contains a substantially higher percentage of fully-employed workers than was true in 1950.

Despite the remarkable economic expansion of the past twenty years, the number of fully unemployed workers is about the same today as in 1950. Since the labor force has grown, however, the unemployment rate has fallen from near 15 per cent in 1950 to about 11 per cent today. Interestingly, the unemployment rate for men is considerably higher than for women. In 1967, 14 per cent of the male labor force was unemployed, but only 10 per cent of the female labor force. The reason is partly that the new industries introduced into the Island are predominantly light industries, with women constituting about 60 per cent of their employment. The general expansion has also brought an active demand for women in clerical. sales, teaching, and other positions.

In addition to full-time unemployment, there is also a substantial amount of underemployment. In 1967, in addition to the 99 thousand reported as wholly unemployed, there were 96 thousand working less than 30 hours a week, and 27 thousand who reported themselves as employed but not working. While the data do not permit a distinction between voluntary part-time work and involuntary underemployment, one would judge that the latter is substantial and considerably higher than in the mainland United States.

It would not be fair to conclude, however, that no progress has been made on the employment front. There has been progress in three respects. First, the rate of full-time unemployment has declined moderately since 1950. Second, while there is still much partial unemployment, this has also declined considerably. The 1951 labor force

survey reported that 31.9 per cent of the male labor force was working less than a full week. The corresponding figure for 1967 is only 12.3 per cent. This improvement must be due partly to the shrinkage of the agricultural labor force, where less than full-time work was particularly prevalent. Third, there has clearly been a marked improvement in the quality of employment. The new jobs which have replaced the older ones involve more skill and training, offer higher wage levels, and present greater opportunities for occupational advancement.

III. THE BEHAVIOUR OF MANUFACTURING EMPLOYMENT

In many developing countries it has been observed that the employment elasticity of increases in manufacturing output is quite low. Certainly this has been true in Puerto Rico. Between 1950 and 1967 manufacturing output in real terms increased about six-fold. Manufacturing employment, however, rose only from 55 thousand to 129 thousand workers, or about 135 per cent. It may be useful, therefore, to attempt an explanation of this behaviour.

The new industrial establishments in Puerto Rico are almost all branch plants of American companies. The equipment is imported from the mainland and the plants are designed to mainland standards. We found little effort to adjust technology to local factor proportions, except for a somewhat greater use of labor for material handling and other supplementary operations.

Despite a substantially similar technology, however, these plants in their early years of operation achieved much lower levels of output per worker - typically less than half of the mainland level. Our field visits revealed really remarkable instances of inefficiency. Among the plant managers we interviewed, almost half had never before occupied a management position, and some had no industrial experience of any sort. First-line production supervisors had been chosen largely from the local population, often on the ground of fluency in English, which is scarcely a sufficient qualification. Workers were often carelessly selected,

training methods were inadequate, standards of expected output were low, waste of materials and spoiled work were excessive, labor turnover and absenteeism were high. In many plants, the feeling seemed to be that, with wage rates so low, one could scarcely avoid showing a profit.

But there is such a thing as learning by doing. Efficiency would doubtless have risen gradually over the years simply as a result of accumulated experience of managers, foremen, and workers. In the Puerto Rican case, however, a rising wage level provided an additional stimulus to learning. The behaviour of the manufacturing wage level in Puerto Rico relative to the mainland is shown in Table 5. While the figures are in current dollars, the increase in the consumer price index over this period was moderate, and was also much the same in both countries. Note that the manufacturing wage level in Puerto Rico increased four-fold, rising from about one-quarter of the mainland level at the beginning of the period to more than one-half at the end.

Why should the wage level have risen so rapidly in a context of substantial unemployment? One might seek possible economic reasons for this behaviour. While the total labor supply may have been ample, the market for supervisor, trained or trainable factory workers may have become tighter as demand for such workers increased. A large part of the explanation, however, is undoubtedly political. There is strong pressure from both employers and unions on the mainland for higher wages in Puerto Rico, to reduce the competitive threat of "cheap labor" imports, and this pressure is effective because of the unusual wage-setting system on the island. Minimum wages are set separately for each branch of industry, including agriculture, through an industry committee system. Each industry committee contains union, industry, and public representatives from the mainland as well as from Puerto Rico. The Puerto Rican employer's representatives, who alone have a strong incentive to resist wage increases, find themselves outnumbered and outvoted. The outcome is a legally-enforced wage which is typically above the

current supply price of labor, as evidenced by the fact that actual wages hover very close to the legal floor.

The rapid rise of wages has retarded the expansion of manufacturing employment in Puerto Rico in two ways. First, it has gradually reduced the locational advantages of Puerto Rico and thus tended to retard the inflow of mainland capital. Second, and of more immediate concern here, it has provided a strong incentive for efficiency improvements in the existing plants. This has not, for the most part, taken the form of capital-labor substitution. Given the already capital-intensive technology of these plants, little further substitution was feasible. Rather, it has taken the form of improvements in personnel and production management. As wage levels rose, incompetent managers and supervisors were replaced, job layout was improved, work crews were trimmed down to a minimum size, training and supervision were improved, standards of expected output were raised, costs of turnover and absenteeism were lowered.

Thus labor requirements per unit of product were reduced, not so much through larger capital inputs as through larger (or higher-quality) inputs of management effort. Anyone familiar with industry realizes that this is usually possible. The Puerto Rican experience illustrates the magnitude of the productivity gains which can be achieved during the early stages of industrialization.

The average capital-output ratio for all Puerto Rican manufacturing has not changed materially over the years. What has happened is a sharp reduction in the use of labor relative to <u>both</u> capital and output. This means that for any cohort of plants established, say, in 1960, there will be a kind of radioactive decay of employment in subsequent years. This can be expected to happen in any event, but the rate of decay will be raised by wage pressure. Thus, a certain rate of new investment is required simply to maintain the level of manufacturing employment, and a higher rate will be needed to increase it. Unless these magnitudes are estimated for a particular country and built into employment projections, the projections will be unduly optimistic.

IV. CONCLUSION

The story of Puerto Rico's industrial development is certainly a success story. It would probably be hard to find another country with a similar conjuncture of favourable circumstances: massive inflows of outside capital, a spectacular expansion of manufacturing output, an unusually high rate of overall output growth, a moderate and declining rate of population increase, the possibility of emigration as a further brake on labor force growth. Under these conditions, one might have expected the large labor surplus which existed in 1940, or even in 1950, to be absorbed quite rapidly either at home or abroad.

Substantial progress has indeed been made. Yet the economy remains a good distance from full employment. Reducing part-time unemployment to full-time equivalents, the unemployment rate is probably over 15 per cent. In addition, there is doubtless a good deal of "hidden unemployment", i.e. people not now in the labor force who would choose to enter if the level of aggregate demand were higher. Research studies in the United States and other developed countries indicate that there are many such people in periods of slack demand.

The lesson appears to be that, even under the most favourable circumstances, elimination of an initial labor surplus is a very gradual matter. Under less favourable circumstances, the surplus may readily grow during the early decades of development. To gloss over the problem by optimistic employment projections or plan targets is no service to the economy. Rather, there must be more energetic pursuit of employment opportunities, not only in the modern industrial sector - whose absorptive capacity is at best quite limited - but in other areas of the economy. To speculate on which areas are most promising and to discuss possible employment-creating strategies would require more space and more knowledge than I have at this moment. I would emphasize only that this is the most important single problem confronting most of the less developed countries in the near future.

STATISTICAL APPENDIX

TABLE 1

NET INCOME BY INDUSTRIAL ORIGIN, SELECTED YEARS

(millions)

Industry	1940		1950		1960		1967	
	$	%	$	%	$	%	$	%
All Industries	225	100.0	614	100.0	1362	100.0	2775	100.0
Agriculture	71	31.6	149	24.3	188	13.8	183	6.6
Mining	-	-	1	0.2	2	0.2	9	0.3
Manufacturing	27	12.0	89	14.5	291	21.4	678	24.4
Contract Construction	3	1.3	27	4.4	84	6.2	236	8.5
Transportation and Public Utilities	18	8.0	49	8.0	123	9.0	248	8.9
Trade	27	12.0	102	16.6	237	17.4	495	17.8
Finance, Insurance, Real Estate	25	11.1	52	8.5	136	10.0	327	11.8
Services	21	9.3	43	7.0	132	9.7	355	12.8
Government	19	8.4	70	11.4	175	12.9	387	14.0
Rest of the World	16	7.1	31	5.1	-5	-0.4	-142	-5.1

TABLE 2

INDUSTRIAL DISTRIBUTION OF EMPLOYMENT, SELECTED YEARS

(thousands)

Industry	1940 No.	1940 %	1950 No.	1950 %	1960 No.	1960 %	1967 No.	1967 %
All Industries	512	100.0	596	100.0	543	100.0	684	100.0
Agriculture	230	44.9	216	36.2	125	22.8	93	13.6
Home Needlework	45	8.8	51	8.6	10	1.8	-	-
Manufacturing	56	10.9	55	9.2	82	15.1	129	18.9
Mining	1	0.2	1	0.2	2	0.4	-	-
Construction	16	3.1	27	4.5	45	8.3	67	9.8
Transportation and Public Utilities	20	3.9	30	5.0	39	7.2	48	7.0
Trade	53	10.4	90	15.1	97	17.9	126	18.4
Finance, Insurance, Real Estate	2	0.4	3	0.5	6	1.1	11	1.6
Services	73	14.3	77	12.9	76	14.0	111	16.2
Government	13	2.5	45	7.6	63	11.6	95	13.9
Others	4	0.8	-	-	-	-	-	-

TABLE 3

NET EMPLOYMENT CHANGE BY SECTORS - 1940-67

	(thousands)	
Expanding Sectors	Number	Percent
Manufacturing	73	19
Construction	51	13
Transportation and Public Utilities	28	7
Trade	73	19
Finance, Insurance, Real Estate	9	2
Service, other than domestic 1/	78	20
Government	82	21
TOTAL	394	100
Contracting Sectors		
Agriculture	-137	60
Sugar Mills	- 15	7
Home Needlework	- 45	20
Domestic Service 1/	- 30	13
TOTAL	-227	100

1/ Estimated; no figure for employment in domestic service was given in the 1940 Census.

TABLE 4

LABOR FORCE, EMPLOYMENT, AND UNEMPLOYMENT - 1950-69

(thousands)

Year	Labor Force	Employment	Unemployment	Unemployment As Percent of Labor Force
1950	705	601	104	14.3
1955	643	551	92	14.3
1960	627	555	72	11.5
1965	769	680	89	11.6
1969	819	729	91	11.0

TABLE 5

AVERAGE HOURLY EARNINGS IN MANUFACTURING
PUERTO RICO AND UNITED STATES 1950-69

Year	Puerto Rico $	United States $	Puerto Rico As Percent of United States
1950	0.42	1.50	.27
1955	0.61	1.91	.32
1960	0.98	2.30	.43
1965	1.27	2.61	.49
1969	1.70	3.19	.53