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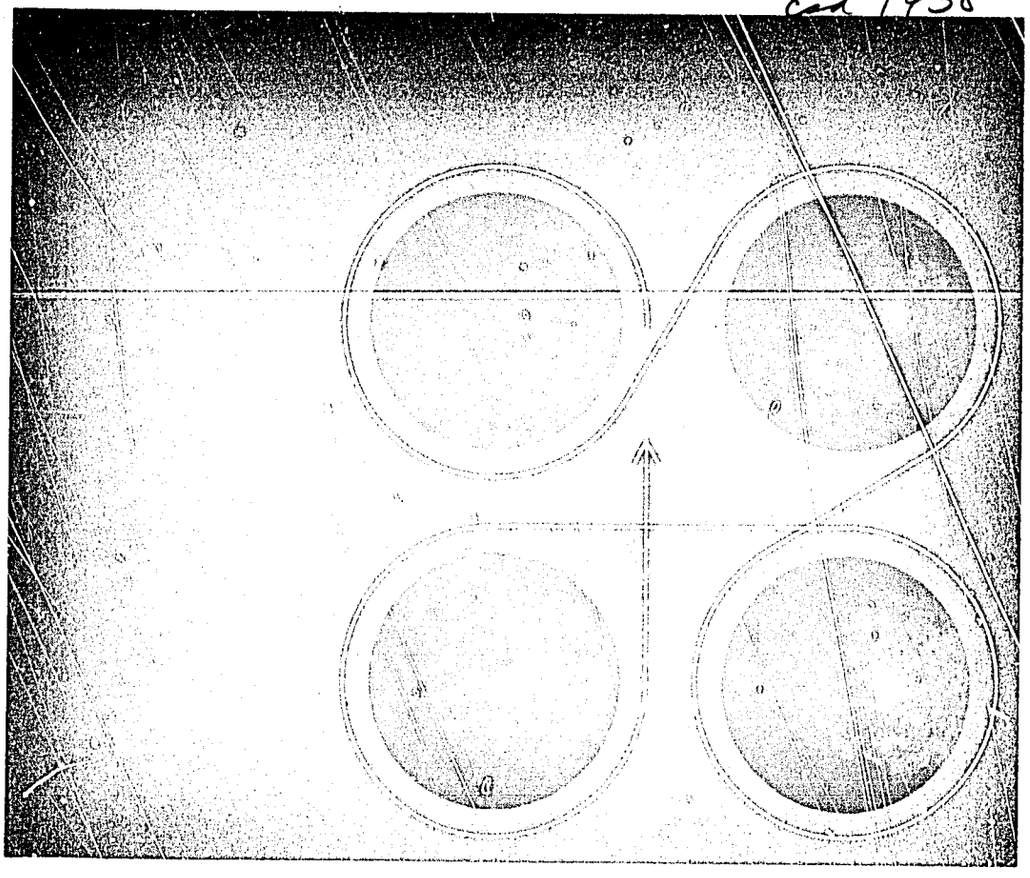

Impact of the Sonauli-Pokhara Highway on the Regional Income and Agricultural Production of Pokhara Valley, Nepal

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Contents

Chapter 1. Introduction ---- 3
Purposes and objectives of this research ---- 3
Methodology ---- 4
Description of Pokhara Valley ---- 4

Chapter 2. Pattern of consumption ---- 8
Effect of caste or tribe and income on consumption ---- 8
Effect of location and income on consumption ---- 9
Effect of prices on consumption ---- 13
Seasonal changes in consumption ---- 13
Distribution of income ---- 14
Sources of income ---- 14

Chapter 3. Cropping patterns of Pokhara ---- 17
Types of agricultural land ---- 17
Area of Khet ---- 18
Area of Pakho ---- 22
Cropping pattern ---- 22
Livestock holdings ---- 24
Varieties and yields of major crops in 1968 ---- 25
Production estimates for 1968 ---- 29

Chapter 4. Trade and commerce ---- 29
Pokhara farmers and the market ---- 29
Pattern of trade ---- 31
Price differentials and cost of transportation ---- 39

Chapter 5. Economic effects of improved transportation ---- 42
Short- and medium-run effects ---- 43
Long-run effects ---- 44

Chapter 6. Additional components of development ---- 53
Population growth ---- 53
Industrialization and tourism ---- 54
Gurkha pensions and remittances ---- 55
Institutions required for development ---- 55

Chapter 7. Projections of regional income ---- 59
Analytical framework ---- 60
Regional income in 1968 ---- 61
Projections of regional income for 1973 ---- 68
Projections of regional income for 1978 ---- 70

Chapter 8. Summary and conclusions ---- 72
Objectives ---- 73
Farmer response ---- 73
Regional planning ---- 75
Projections of regional income ---- 77

Appendix ---- 79

Impact of the Sonauli-Pokhara Highway on the Regional Income and Agricultural Production of Pokhara Valley, Nepal*

Mark C. W. Schroeder† and Daniel G. Sisler‡

Chapter 1. Introduction

In April, 1968, public traffic was allowed to flow on the Sidhartha Rajmarq or Sonauli-Pokhara highway. This marked the end of Pokhara Valley's separation from the economic forces of the Nepalese terai and northern Uttar Pradesh of India. Previously all goods were brought by headload or occasionally by mule over a mountainous trail which required 5 or 6 days to traverse. Besides foot trails the only other means of access to the valley was by Dakota airplane. Thus, high transportation costs insulated Pokhara Valley from the economic conditions of the surrounding areas.

Purposes and Objectives of This Research

The purposes of this study are to provide an analysis of the economy of Pokhara Valley before construction of a road into the valley changed the traditional pattern of farming and to appraise the effect of improved transportation on that economy.

Specifically the objectives are:

- To develop a methodology for measuring change in regional income caused by the introduction of a highway into a populated, but previously isolated, agricultural area. Particular attention is given to measuring changes in volume, direction, and type of goods traded, and to the measurement of increased agricultural production produced as a result of improved transportation and communications.
- To determine the potential of the individual farmer to respond to: new technology, government programs, and changes in absolute and relative prices.

* The material herein is adapted from a thesis presented to the Faculty of the Graduate School of Cornell University in partial fulfillment of the requirements for the degree of Doctor of Philosophy.

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To provide information useful to those planning the development of Pokhara Valley. The analysis will attempt to predict the transformation of the valley. Consideration will be given to the amount and combination of complementary physical inputs required and the institutional structure within which development will occur.

Methodology

This study examines the regional development of one of the most important areas of Nepal. It will concentrate on the overall development of the valley rather than the narrow effect of reduced transportation cost on existing trade. Improved transportation and communication change a broad range of relationships, especially when the improvement is as drastic as in the Pokhara case.

The regional income of Pokhara Valley is estimated both from an analysis of expenditures of the valley residents, and from an analysis of the sources of the various components of regional income. Projections from these base estimates are made to determine how regional income will change as a result of the construction of a highway.

This study discusses the complementary investments which may be needed to increase the regional income of Pokhara. It considers explicitly changes in technology of the agricultural sector, changes in resource use, changes in trade patterns, and changes in flows of income. Resulting increases in regional incomes cannot be attributed only to the road, but to an overall restructuring of the economy.

Traditional methods of transportation analysis are too limited in scope to effectively measure the economic impact of improved transportation on Pokhara Valley. A more meaningful measure of the role transportation plays in economic development is its effect on regional income. The regional income approach of transportation analysis has 2 functions. It may be used to provide information for regional development or it may be used for transportation planning. This study is concerned with regional development, but the method employed and the information generated could be used for transport planning.

Description of Pokhara Valley[1]

Geography

Pokhara Valley lies in the hills 96 miles west of Kathmandu, the capital of Nepal. The lower extremity of the valley lies 2500 feet above sea level and the upper end, which is 15 miles distant, is approximately 3500 feet above sea level. Maps of Nepal and Pokhara Valley are presented in figures 1 and 2

[1] An excellent study of the regional geography of Pokhara has been recently completed. Subjects briefly outlined here are treated at length in Harka Bahadur Gurung's *Pokhara Valley, Nepal Himalaya: A field study in regional geography.* (Dissertation, University of Edinburgh, 1966).

Figure 1. **Nepal — Study area and Sonauli-Pokhara highway.**

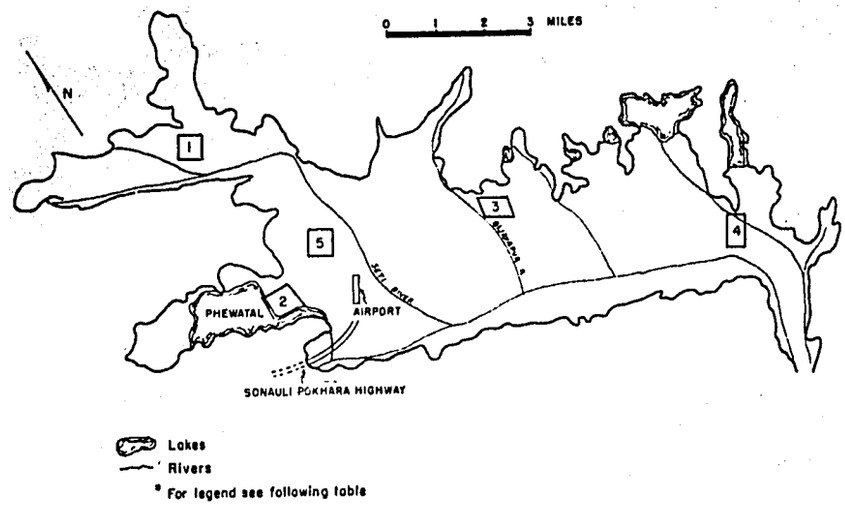

Figure 2. **Pokhara Valley, Nepal.***

The Seti River enters the valley at the north and flows south to the edge of the valley, then turns southeast and runs the length of the valley on its southern edge. It is not suitable for irrigation purposes because of sediments in the water and because it generally flows far below the level of the agricultural land in the valley floor. Several tributaries are used extensively for irrigation. These include the Marsi Khola, Kali Khola, Kahun Khola and Bijayapur Khola.[2]

Several lakes lie within the valley. Their outlets provide important irrigation water for much of the paddy area. The volume of outflow from these lakes depends to a great extent on the precipitation in the surrounding hills.

Climate

Gurung classifies the climate of Pokhara as humid tropics type Aw (Koppens modified system of classification) because the mean temperature is always above 56°F and the summer mean is 72°F.[3] In Pokhara the southwest monsoon usually begins in the middle of June and lasts for three months until the middle of September.

During this time 75 to 80 percent of the annual rainfall occurs. Northwest winds bring light winter rains in December. In 1963[4] the annual

[2] Khola is the common term for medium and small rivers in Nepal.

[3] Gurung, *op. cit.*, p. 49.

[4] Period for which rainfall measured extended from April 15, 1963 to April 15, 1964, or the Nepali year 2020.

rainfall was 122 inches at the Pokhara agronomy farm.[5]

Crops

Rice is the most important crop and is transplanted into flooded paddy fields. The unirrigated but fertile land is planted to maize which is often followed by transplanted millet. Other less important crops include sugar cane, groundnut, soya bean, buckwheat, lentils, oranges, and bananas. The forest cover has been almost entirely used for fuel, but there remain some chilaune, dhairo, simal, bar, peepul, oak, and bamboo trees.[6]

People

The inhabitants of Pokhara are a heterogeneous lot. The majority of the people in Pokhara and the immediate hills are either Brahmin or Chetri. In addition to these high castes there are a few members of lower castes such as Damai and Dargi (tailors), Kami (blacksmiths), Jogi (fishermen), Sarki (leatherworkers), and Gaeyni (musicians).

But in Nepal, caste is not of major importance because many people, perhaps a majority, are not included in the caste system. In the hills around Pokhara are many people belonging to the Magar and Gurung tribes. The Magars are found to the south and west while the Gurungs live on the southern slopes of the Annapurnas. These two tribes have supplied many soldiers to the famous Gurkha regiments of the British and Indian armies.

The merchant community is composed primarily of two other tribes, Newars and Thakalis. Most important are the Newars, who are the traditional merchants of the middle hills in Nepal. An ancient race, probably of Mongolian origin, they have lived in Kathmandu Valley since the sixth Century B.C.[7] Perhaps two-thirds of the merchants in Pokhara are Newar and many have been in Pokhara for about three generations.

The next most important merchant group is the Thakalis. These people traditionally traded with Tibet and their home is in Tukche in Thak which lies northwest of Pokhara.

Finally there is a sizable Mussulman community in Pokhara, with a small mosque in Matipani, the very eastern section of Pokhara bazar. Many of the Mussulman work as tailors or bangle sellers, but generally they appear to be quite poor.

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[5] M. L. Pradhan, *et al.*, Soil survey of some areas of Pokhara and Syangja, Gandaki Zone, p. 3. Dept. of Agr., Soil Survey Project. (Kathmandu: His Majesty's Government, 1964.)

[6] Comprehensive discussion of vegetation is found in Gurung's *Pokhara Valley, Nepal Himalaya*, pp. 63-83.

[7] Regmi, D. R. Ancient and medieval Nepal, p. 1. (Kathmandu, 1952.)

Chapter 2. Pattern of Consumption

The variables to be considered in this chapter are consumption, or in some cases, expenditure of the household as a function of household size, income, caste and location within the valley.

Effect of Caste or Tribe and Income on Consumption

Introduction

A sample of 125 families that included all of the major castes and tribes found in Pokhara was selected. Figure 2 shows the location of the sample areas within Pokhara Valley. They were chosen purposely to include different cropping patterns and castes. Table 1 presents the distribution by caste of the sample families. Because membership in caste or tribe determines many of the traditions, social functions, and occupations, its effect on consumption was analyzed.

Estimating equation

To determine whether consumption of food varied greatly between castes, as suggested by the general observation of eating habits, a regression was run using caste as a zero-one or dummy variable. The regression equations were of the semilog type, and were fitted by the method of least squares to the data of the 100 households for which income estimates were available.

1) $Y_1 = a_0 + \Sigma a D_j + B_1 \log X_1 + B_2 \log X_2 + u$

where D_j shifts the intercept according to caste $j = 1\text{-}5$

and X_1 = household income

X_2 = household size

Y_1 = household consumption of item

The form of equation (log, semilog, etc.) affects the value of the coefficients, which suggests that the estimates of the marginal propensity to consume must be accepted with caution. The semilog equation was used, because it not only fitted the data better for most commodities, but also because it has properties that make it desirable from a theoretical point of view. The demand for a good increases at a decreasing rate, as income rises. Also the relative increase in demand for a good in response to a given change in income decreases with higher levels of income.[8] Dummy variables were used to shift the intercept according to the caste of the household. The average consumption estimates presented in table 2 imply that with any given level of income and family size, consumption will vary according to the caste of the household. For example, a Brah-

[8] Derivative of demand with respect to income given $y = a + b \log x$ is b/x where x is income. Income elasticity is $\frac{b}{y}$.

Table 1. Distribution by caste and tribe* of sample households
(Pokhara, Nepal, 1968-69)

Area	Castes				
	Brahmin	Chetri	Newar	Gurung†	Others‡
	number of households				
Lamachaur (1)	0	21	1	1	2
Baidam (2)	17	7	0	0	1
Argaun (3)	5	19	1	0	0
Satmuhane (4)	4	4	8	5	4
Bazar (5)	7	0	16	1	1
Total	33	51	36	7	8

* Caste includes Brahmin and Chetri. Tribe includes Newar and Gurung.
† Includes Thakali.
‡ Includes Sarki, Damain, Jogi, and Mussulman.

min household of 5.2 people with an income of Rs. 2884 will consume Rs. 102 worth of meat; whereas a Newar household of the same size and income would consume Rs. 265 worth. A Rs. 100 increase in income would stimulate an additional Rs. 1.55 expenditure on meat in both households because of identical marginal propensities to consume. One hundred rupees equals approximately 10 American dollars. ($1 = Rs. 10.25).

Results of the analysis

Although all 25 items were analyzed, only the consumption of a few items appears to be strongly related to differences in caste. Table 2 presents the average consumption by caste of these items. The marginal propensity to consume (computed at the mean) and the overall coefficient of determination for the estimating equation is also given. Caste and income were not closely related.

The results of the analysis indicate that caste is not an important factor in determining the diet of the valley inhabitants. Improved transportation and communications may expose more Nepalese to the food prejudices found in Uttar Pradesh. In general, meat, sugar, cloth, and to a lesser extent eggs and ghee seem to be the only items which are significantly affected by the caste of the consumer. A more satisfactory explanation of differences in household consumption of other items is the location of the consumer within the valley.

Effect of Location and Income on Consumption

Introduction

Location of the household plays a particularly important role in the consumption pattern of a subsistence economy. The resource base of an

Table 2. Effect of caste and income on household consumption, semilog function

(100 households, Pokhara, Nepal, 1968)

Item	Marginal propensity to consume	Consumption by caste‡ at mean value† of function					Equation
		C_1	C_2	C_3	C_4	C_5	R^2
				liters			
Meat	.0155**	102	130	265	229	183	.62
Eggs	.0012*	2	2	20	6	12	.34
Cloth	.0825**	231	214	159	14	426	.45
Cloth§	.0490**	244	217	173	5	344	.54
				rupees			
Ghee	.0026**	26	18	22	14	17	.51
Sugar	.0056**	37	23	100	20	41	.39
				kilograms			
Kerosene	.0036**	25	18	41	24	31	.45

* Income coefficient significant at 95% level probability.
** Income coefficient significant at 99% level probability.
† Computed at geometric mean of income (Rs. 2884) and family size (5.227 people). Note: $1 = Rs. 10.25.
‡ C_1 = Brahmin, C_2 = Chetri, C_3 = Newar, C_4 = Gurung, C_5 = Other (Sarki, Damai, Jogi, and Musselman).
§ Linear equation. Consumption estimated at arithmetic mean.

individual farm and the associated costs of production set the pattern of consumption. The proportion of total production that passes through marketing channels is small and the cropping pattern of an individual farm is an important determinant of the household consumption.[9] In selecting the sample regions, care was taken to obtain areas with different resource bases. The costs of production, therefore, were significantly different, and farmers had adopted different cropping patterns.

Area 1,[10] ***Lamachaur,*** is heavily populated and has a very limited paddy area and a high proportion of *pakho* or dry land. The village is large, with many fruit trees in the corn fields. There are some dry marginal river terraces adjacent to the village.

Area 2, Baidam, is heavily populated and has scattered paddy areas on the shores of the lake and also considerable pakho land.

[9] Using Miracle's criterion, Pokhara farmers generally fall into the category of extreme isolation even though compared to most Nepalese, they do not seem isolated. Marvin P. Miracle, "Subsistence Agriculture: Analytical Problems and Alternative Concepts," *AJAE* 50 (2): 302. May 1968.

[10] The terms "area" and "region" are used interchangeably in this study.

Area 3, Argaun, lies just east of the Bijayapur River, and the area sampled was practically all well-drained, early paddy land. Most of the wheat is produced in this area, and the pakho land is very limited. The houses are scattered and population pressure is less.

Area 4, Satmuhane, is a relatively recently settled area at the eastern end of the valley. There is practically no pakho land or fruit trees. Most of the paddy is of a fine, late-maturing variety.

Area 5 is the bazar and the houses directly behind the shops. This was omitted from the analysis because of the lack of data on incomes.

Estimating equation

The regression equation used was a semilog equation identical with (1) except that zero-one variables were used to shift the intercept according to the location

$$2)\ Y = a^{o} + \Sigma a D_j + B_1 \log X_1 + B_2 \log X_2 + u$$

where D_j shifts of the intercept according to region (1-4)
and X_1 = household income
X_2 = household size
Y = household consumption of item.

In Table 3, the average consumption for each region is given as well as the marginal propensity to consume each item. The figures for average consumption imply that with any given level of income and family size, the consumption will vary according to region. For example, households in Region 1, with an income of Rs. 2884 and a household size of 5.23 people, consume 456 kilograms of rice, whereas a household in Region 2 with the same income and family size consume 827 kilograms of rice. For Region 5 average consumption is presented without adjustment for income because income data were not available for this location.

The marginal propensity to consume is the increase in consumption associated with a one rupee increase in income, holding family size constant. If the regression coefficient was significantly different from zero, based on the T-test, the corresponding marginal propensity to consume was starred. If the t value exceeds .1665, there is a 95 percent probability that the coefficient is not equal to zero. The critical value for a 99 percent probability is 2.380. These estimates of marginal propensity hold only for small changes in income. With a major shift in technology, the whole function will shift and the movement along the function will be overshadowed. Nevertheless, for small changes in income the estimates are reasonable because there are *some* purchases and sales of agricultural commodities and there *is* a market. Using total income instead of agricultural income, or nonagricultural income, or each separately, provided better estimates. This indicates that agricultural and nonagricultural income are substitutes on the margin.

The importance of location and its associated cost of production is

Table 3. Effect of location and income on household consumption, semilog function

(125 households, Pokhara, Nepal, 1968-69)

Item	Marginal† propensity to consume	Consumption by location using mean value of function† ‡					Estimating equation
		L_1	L_2	L_3	L_4	L_5§	R^2
				kilograms			
Rice	.04802**	456.0	827.0	782.0	930.0	730.0	.70
Millet	.0121	554.0	333.0	71.0	67.0	53.0	.66
Maize	.0250*	535.0	485.0	225.0	147.0	191.0	.61
Wheat	.0057	37.0	40.0	138.0	27.0	60.0	.43
Pulse	.00626**	70.3	65.7	86.7	74.4	47.6	.46
Milk	.01139**	72.9	158.0	179.0	116.5	124.9	.40
Ghee	.00239**	14.6	22.2	22.7	19.8	19.4	.47
Oil	.00034	11.2	17.4	16.2	15.1	24.1	.45
Salt	.00196**	52.9	57.5	49.0	48.3	44.6	.67
Spice	.00036**	4.4	7.7	6.1	5.8	4.6	.67
Sugar	.00653**	14.9	17.7	35.5	74.6	56.9	.43
				liters			
Kerosene	.0036**	13.2	22.2	22.2	36.0	20.4	.52
				rupees			
Vegetables	.0059**	109	108	143	70	141	.86
Tea	.0082**	39	120	17	63	46	.48
Cigarettes	.0131**	67	150	88	112	80	.37

* Income coefficient significant at 95% level probability.
** Income coefficient significant at 99% level probability.
† Computed at geometric mean of income (Rs. 2884) and family size (5.227 people).
‡ L_1 = Lamachaur (1), L_2 = Baidam (2), L_3 = Argaun (3), L_4 = Satmuhane (4), L_5 = Bazar (5).
§ Area 5 is estimated from average per capita consumption times 5.227 family members. Not estimated from regression equation or adjusted for income.

clearly illustrated by the differences in grain consumption between regions. In Region 1, rice consumption takes third place behind both maize and millet.[11] This reflects the relative shortage of land suitable for paddy. Regions 2, 3, and 4 consume almost twice as much rice, on the average. In Region 1, where there is a real shortage of land, practically all the maize land is planted to millet immediately after the harvest, and this grain is an important staple of the diet. In Region 2, where the inhabitants are slightly better off, less of the maize land is followed by millet. Transplanting millet is a laborious and time-consuming job and the new seedlings often fail. Millet, however, provides good insurance for bad years, since it may be stored for 80 years without loss of germina-

[11] African millet, *Eleusine Coracana Gaertner;* the Nepali term is *kodo.*

tion and remains edible throughout this period. In Regions 3 and 4, there is very little pakho land, and maize and millet production (and consumption) are correspondingly low.

Wheat consumption is low everywhere, but the households of Region 3 consume 3 to 5 times as much as any other region. A few years ago (1964) no wheat was grown in this area. But early paddy soils, some irrigation, and most important, the introduction of the Lerma 52 variety, have made it profitable to plant much of this area to wheat. The acceptance of this grain as a significant portion of total grain consumption (approximately 11%) suggests that there is no taste or preference barrier to consuming at least this amount of wheat. In fact, there is such a strong demand for Mexican wheats for seed that the price is higher for them than for traditional wheats that are of finer quality.

The implication of the foregoing discussion is that there is great variability in the consumption pattern of the inhabitants of Pokhara. Caste affects the consumption for some items, but for most, location of the family within the valley is the dominant force. Location may be important because of different settlement and social patterns, because of varying distance to the road or bazar, or because each location has a different resource base in terms of soils and irrigation. This last factor is by far the most important for grain consumption.

Perhaps the most significant conclusion to be drawn is that the variability in consumption is much greater in a subsistence agricultural area than in a community where the market plays an important role in distributing food items. The analysis indicates that families of the same caste living in different locations have distinctly different patterns of consumption. This implies that those improvements associated with the new highway that alter production and the availability of food items (particularly food grains) will not meet with resistance resulting from caste barriers or tradition. New crops or varieties introduced into the valley should be readily accepted if they are more profitable than the traditional ones.

Effect of Prices on Consumption

There are too many other factors affecting consumption and purchases to empirically determine the price elasticity of demand for commodities. In the case of grains practically every consumer is a producer and consumption depends on location and income as previously discussed. In November and December the rice crop is divided between tenant and landlord, payments in kind for plowing are made, and most contractual agreements are settled. Very little actual cash is transferred at this time.

Seasonal Changes in Consumption

Seasonal variation in consumption is important for 3 reasons. First, it again indicates how closely related home consumption is to the produc-

tion possibilities of the individual farm. Whether rice or maize or millet is the major food in Lamachaur depends on the season. Secondly, the seasonal variation indicates that there are few custom or taste preference restraints on substitution of grains. Thirdly, it illustrates the limitation of the marketing function. When maize is harvested, little is sold to purchase rice. The seasonal pattern shows that consumption of a particular grain is greatest at harvest time and tapers off. As rice supplies are reduced, millet comes in and this, in turn, is followed by corn until rice harvest. Wheat is harvested just after millet but before maize. In the bazar, rice consumption remains almost constant.

Distribution of Income

Because regional development will involve changes in production and, therefore, changes in agricultural income, the present distribution of income must be ascertained. One of the effects of development will be a redistribution of income as the gains from agricultural productivity accrue unevenly to the inhabitants of the valley.

One aspect of the distribution of income is the relative frequency of households with certain per capita income levels. Figure 3 presents the distribution of 100 households classified by the per capita income of each family. Among the 4 areas there are 3 types of distribution. Region 1, Lamachaur, has a relatively normal distribution with most families falling in the middle income groups. Areas 2 and 4 have a relatively skewed distribution with a significant number of families falling in the high income category of more than Rs. 1000 per capita income. Area 3, Argaun, has an unusual distribution in that there are approximately equal numbers of families in each income group. In Area 1, large family incomes are associated with large families. In Areas 2 and 4, large family incomes are not closely related to large families. Thus these two areas have several households where the per capita income is very high, although household incomes are not necessarily high.

Sources of Income

Income data were collected by the close questioning of the enumerator for each area. This method is more accurate in Nepal than in many societies for the following reasons. First, there is little mobility among families, so that land ownership does not often change. Because of the sharing of labor, most families know the landholdings of others. Secondly, there is no culture barrier to asking the level of salaries, pensions, and other cash income. This information is freely given without embarrassment. Thus the breakdown of income represents the enumerators' estimates of income. The income from crops represents a typical year. The estimates were given in physical terms and converted by the author into

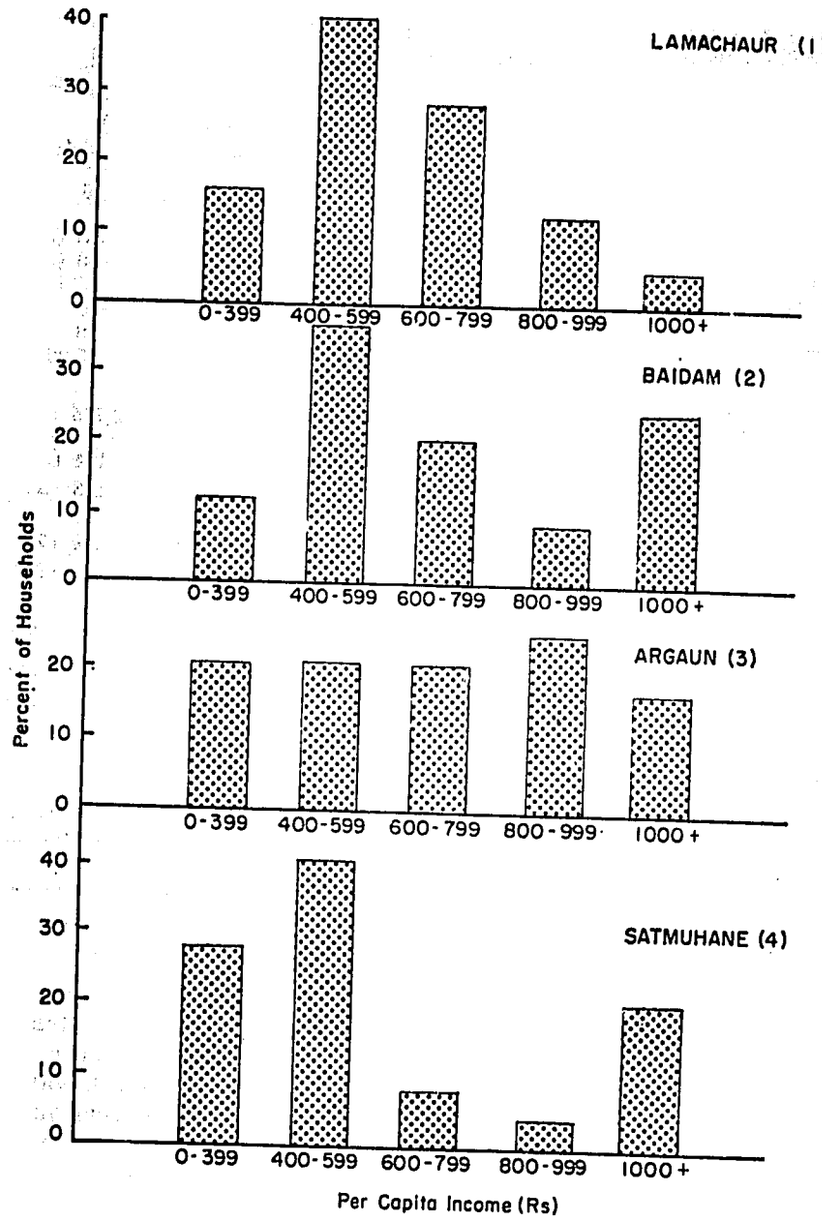

Figure 3. **Distribution of families according to per capita incomes.**
(1000 families, Pokhara)

Table 4. Sources of household income
(100 families, Pokhara, Nepal, 1968)

Item	Lamachaur 1	Baidam 2	Argaun 3	Satmuhane 4
	Rs. %	Rs. %	Rs. %	Rs. %
Paddy	795 (20)	1,198* (43)	2,974 (60)	1,873 (55)
Maize	697 (19)	334 (12)	169 (3)	56 (2)
Millet	532 (14)	270 (10)	60 (1)	73 (2)
Wheat	7†	57 (2)	341 (7)	158 (5)
Sugar	419 (11)	16 (0)	0 (0)	0 (0)
Other‡	212 (6)	115 (5)	159 (3)	75 (2)
Total agricultural income	2,662 (71)	1,990 (72)	3,703 (75)	2,235 (65)
Remittances‖	834 (23)	158 (6)	8†	104 (3)
Service¶	168 (5)	455 (16)	161 (3)	158 (5)
Field and contsruction labor§	74 (2)	74 (3)	940 (19)	219 (7)
Shops	0 (0)	96†	129 (3)	698 (20)
Total nonagricultural income	1,076 (29)	783 (28)	1,238 (25)	1,179 (35)
Total income	3,737 (100)	2,773 (100)	4,941 (100)	3,414 (100)

Note: Percent of total income in parentheses.

* Includes 10% dry land paddy or *gaiya*.
† Less than 1%.
‡ Includes buckwheat, lentil, soybean, peanut, mustard, milk, vegetable, and wood.
§ Column totals do not add because of rounding. Also, includes income from contracts for construction.
‖ Primarily pensions for army service and remittances from active army personnel and from night watchmen in India.
¶ Primarily clerical and menial duty in government offices.

value terms by pricing the grain at Pokhara wholesale market prices.[12] These income estimates rank the households fairly accurately, but are not exact estimates in terms of actual monetary income. When so large a proportion of income is home-produced and home-consumed, both the method of valuation, and definition of income derived from various sources are arbitrary. Between 65 and 75 percent of income is derived from agricultural sources, but the makeup varies according to location

[12] The following prices were used:
Paddy, millet, and maize: Rs. 70 per muri
Wheat: Rs. 120 per muri
A *muri* is a volume measure commonly used for grain and contains 50 kilograms paddy, 62.7 kilograms maize, or 67.3 kilograms millet or wheat.

of the sample. In Area 1 paddy, maize and millet are almost equally important, whereas in Area 3 the most important grain is paddy, although wheat makes a significant contribution. Even in non-agricultural income there is a great variation by location. For example, Area 1 residents receive army pensions, Area 2 residents are in salaried jobs, Area 3 includes construction contractors, and Area 4 has many small shops.

The great variation within the valley is again clearly demonstrated by the analysis of income sources. This has significance with regard to the incidence of benefits derived from improved technology. Improved technology in maize will do little to help inhabitants of Areas 3 and 4 unless they can radically change their cropping pattern to include more of it. New wheat technology, however, would be primarily beneficial in these two areas (3 and 4). Changes in employment in the army and in government offices will primarily affect the people of Regions 1 and 2. In Chapter V, the breakdown of income by its source will be used to estimate the redistribution of income brought about by technological change.

Chapter 3. Cropping Pattern of Pokhara

Types of Agricultural Land

Almost all the agricultural land in Pokhara Valley can be classified into 2 categories by type of use. There is an insignificant amount of scrub forest that covers small hills and moraines in the valley. The most important classification of land is paddy land or *khet*. It is relatively low-lying, intensively planted to rice in the monsoon, and is the most important agricultural land. The khets are divided up into many plots, *gora*, which may be further subdivided into even smaller units, *phat*, for the purpose of water control and division of ownership. Most of the plots vary in size from 1 *murimato* (127 sq m) to 1 *ropani*,[13] (508 sq m). The degree of fragmentation is presented in table 5.

The data presented in this table are for the Kaski district as a whole, which includes several areas outside the valley as defined for this study. Also, the land records date from 1933 and probably underestimate the actual landholding by a large margin. Nevertheless, even if errors are 50 percent, landholdings in the Kaski district must still be considered very small.

For example, 16.7 percent of the landholding families hold less than 0.1 hectares. This includes both owned and rented land and both pakho and khet. This same group of families hold 30.5 percent of the khet land

[13] There are 20 ropanis to a hectare or 8 ropanis to an acre.

Table 5. Distribution of land holdings by size and type
(Kaski District, 1962)

Size category*	Percent of families in each category	Percent of total land held†	
		Khet	Pakho
(hectares)			
0- .1	16.7	0.5	4.9
.1- .2	14.5	2.7	7.8
.2- .3	12.8	5.0	8.3
.3- .4	10.4	6.2	8.3
.4- .5	8.8	7.1	7.9
.5- 1.0	22.1	30.0	26.6
1.0- 2.0	11.8	31.2	24.2
2.0- 3.0	2.0	9.0	7.2
3.0-10.0	0.9	8.2	4.9
Total	100.	100.	100.

* Size of total holding (pakho plus khet) includes land owned and rented.
† Total agricultural land of Kaski District.
Source: Sample Census of Agriculture, Kaski District, 1962, table 4. (Kathmandu: Central Bureau of Statistics, His Majesty's Government, 1966) p. 4.

and 4.9 percent of the pakho land in the district. The sums of the first 7 rows of table 5, show that 97.1 percent of the families hold 2 or less hectares of land. These families hold a total of 82.8 percent of the khet and 97.0 percent of the pakho in the district.

Area of Khet

The area of khet was estimated by using airphotos. First a base map (1″ = 1 mile) was prepared. Then stereo pairs of airphotos were used to determine the paddy areas. Extensive travel throughout the valley determined the boundaries of the paddy areas. The percentage of early rice was estimated by climbing hills on the side of the valley, and ascertaining, by the differences in color, which fields were planted to early rice. Therefore, these are only rough estimates. The area of khet is illustrated in figure 4. This map was used to measure the quantity of land planted to paddy. The letters in each area of khet correspond with the areas given by name in table 6. The total area has been divided into approximate areas planted to late and early maturing paddy.

A total of 4836 hectares of paddy were planted in 1968. Fine, medium, and early maturing varieties were planted in 4080 hectares. About 16 percent or 756 hectares were planted to early paddy. The most important early paddy area is Shyam Sundar (area N in fig. 4). This khet produced 21 percent of the early paddy.

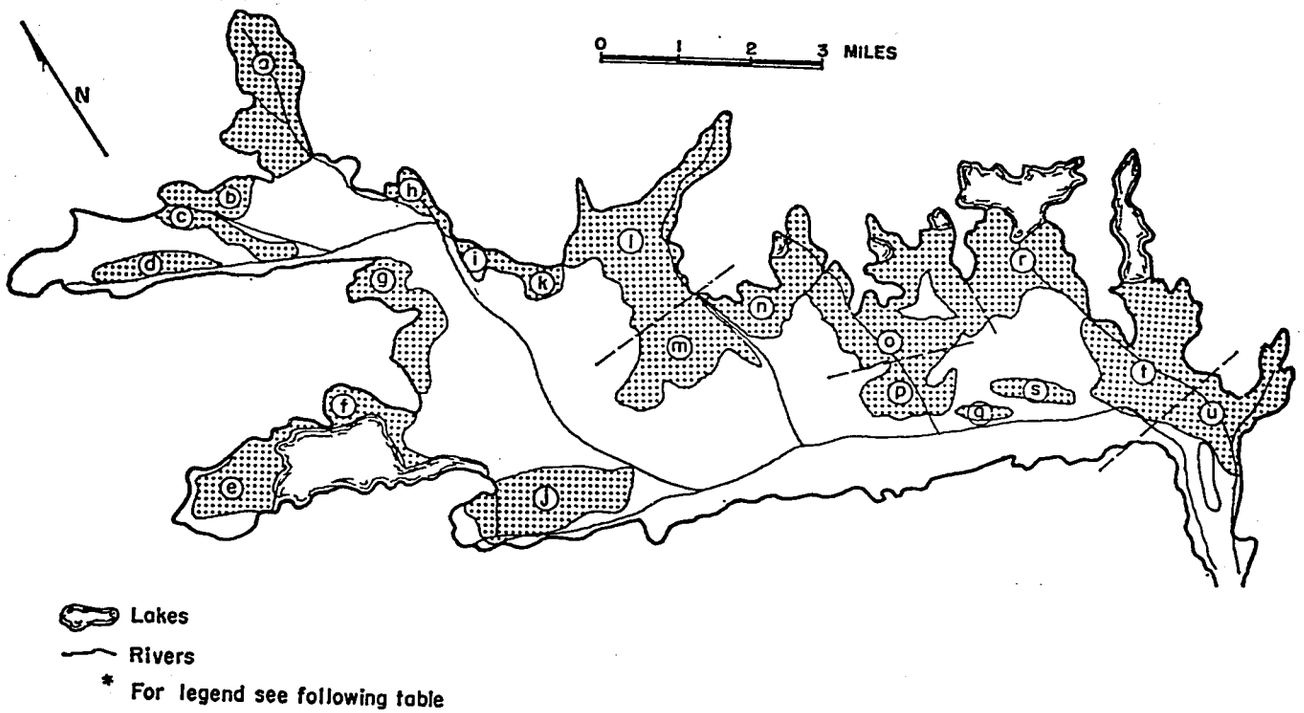

Figure 4. **Paddy production, Pokhara Valley, Nepal.***

Table 6. Area planted to paddy
(Pokhara Valley, 1968)

Khet name	Map key*	Total area	Variety of paddy		Percentage early paddy
			Late	Early	
		ha	ha	ha	
Kali Khola	a	448	448	0	0
Phalai Phat	b	104	83	21	20
North Hyanga	c	108	86	22	20
South Hyanga	d	92	74	18	20
Phewa	e	204	204	0	0
Sedi-Baidam	f	120	108	12	10
Garjati-Malepaten	g	196	157	39	20
Bhalam	h	36	29	7	20
Kaun Kot	i	108	54	54	50
Choripatan and Biruwa	j	400	360	40	10
Banjhakapatan	k	136	109	27	20
North Kundar	l	400	360	40	10
South Kundar	m	376	338	38	10
Shyam Sundar	n	212	53	159	75
Argaun-Sisuwa	o	560	504	56	10
Lower Sisuwa	p	208	166	42	20
Lower Seti River	q	72	54	18	25
Kudi	r	376	338	38	10
Baralthar	s	56	56	0	0
Satmuhane	t	504	403	101	20
Gaungurda	u	120	96	24	20
Total ha; average %		4,836	4,080	756	15.6

* Key refers to figure 4.

Wheat is usually planted on khet land during the winter season. The extent of planting is determined by the availability of irrigation, the possibility of fencing off the cattle which traditionally graze the paddy stubble, and the availability of new varieties of seed. Figure 5 is a map showing the area of land which either has sufficient irrigation now, or, with limited irrigation projects, would have sufficient supplementary water for wheat production. The suitability of the soils for wheat is largely unknown. However, it is assumed that it is feasible to fence these areas, to find suitable varieties, and to provide some irrigation. This is defined as the potential wheat acreage and is compared to the actual wheat acreage in table 7.

In 1968, 630 hectares of wheat were planted. This is only 35 percent of the estimated potential wheat acreage of 1797 hectares.

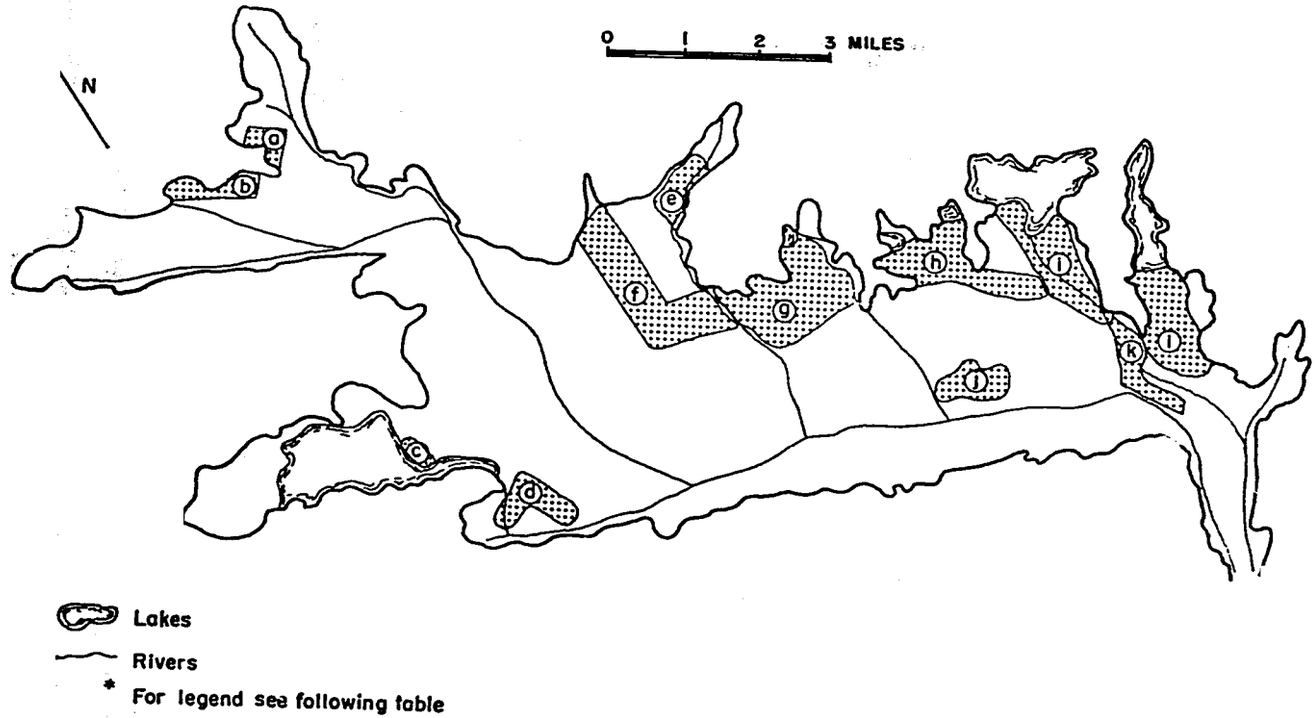

Figure 5. **Potential wheat production, Pokhara Valley, Nepal.***

Table 7. A comparison of potential and actual wheat acreage planted (Pokhara 1968)

Khet name	Map key*	Potential area	Actual area	Actual as percentage of potential
		ha	ha	%
Kali Khola	a	24	0	0
Phalai Phat	b	53	20	38
Baidam	c	12	10	83
Choripatan and Biruwa	d	10	5	5
Banjhakopatan	e	54	5	11
Kundar	f	36	100	30
Argaun	g	348	300	86
Sisuwa	h	228	10	4
Begnas-Kudi	i	216	10	5
Barathic	j	88	50	57
Baralthar	k	88	0	0
Satmuhane	l	240	120	50
Total ha; average %		1,797	630	35

* Key refers to figure 45.

Area of Pakho

The area of pakho was also estimated by use of airphotos in the identical manner used to determine the area of khet. However, an additional adjustment had to be made because practically all the villages, schools, government offices, maidans,[14] and roads lie with the pakho area. Therefore, the agricultural area was estimated to be 80 percent of the total pakho area.

The major crops grown on pakho are maize, millet, gaiya,[15] buckwheat, sugar cane, tobacco, and occasionally wheat. The approximate area in maize and millet is illustrated in figure 6. In tabular form, the area of pakho planted to major crops is presented in table 8. These estimates represent our judgment based on extensive travel through the area on foot and bicycle.

Cropping Pattern

To describe and clarify the cropping pattern in Pokhara Valley an illustration has been prepared (see fig. 7). A representative cropping pattern has been given which shows the percentage of land under each crop

[14] Maidans are grassy open areas, often with a place for the porter to rest, shaded by sacred bar and peepul trees.

[15] Gaiya is an upland rice interplanted with maize and harvested after maize.

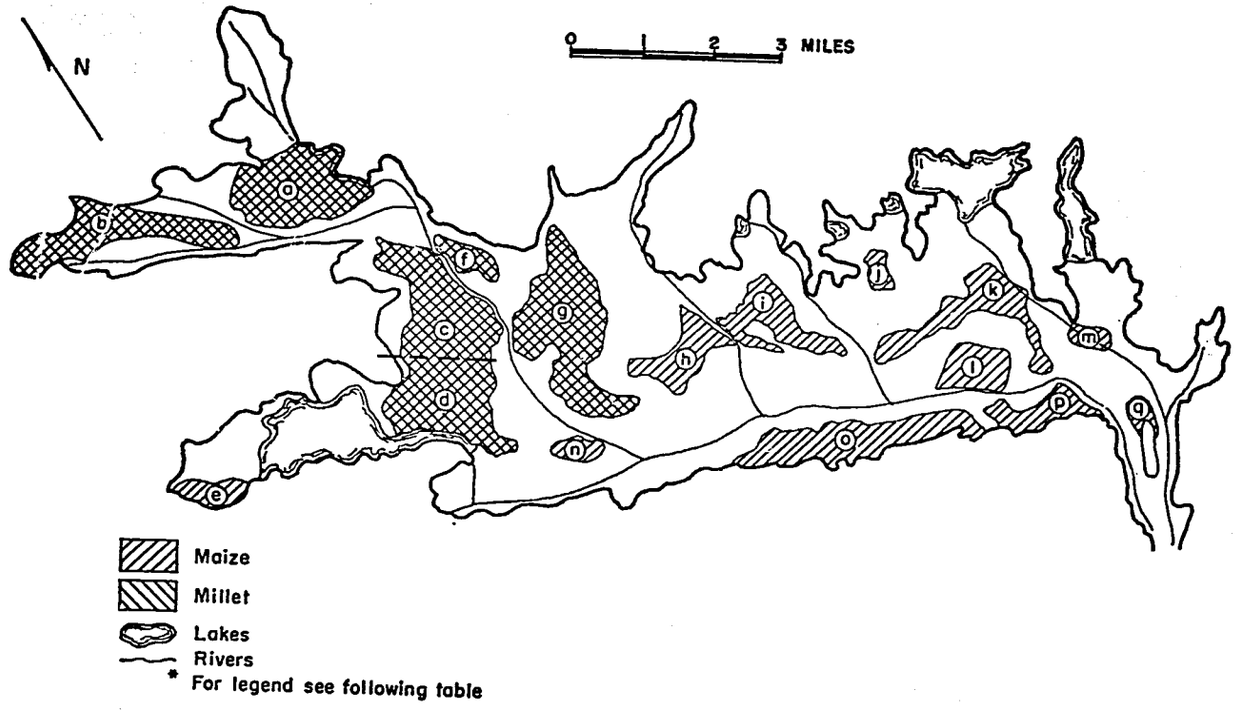

Figure 6. **Maize and millet production, Pokhara Valley, Nepal ***

Table 8. Area of pakho planted to upland crops
(Pokhara 1968)

Pakho name	Map key*	Total area	Area planted to various crops					
			Maize	Millet	Gaiya	Cane	Buck-wheat	Tobacco
		hectares						
Lamachaur and Batulachaur . . .	a	400	320	288	96	16	16	‡
Hyanga	b	344	275	248	82	3	‡	‡
Upper Nagar Panchayat	c	380	228	205	91	2	4	10
Lower Nagar Panchayat	d	448	358	322	143	2	‡	4
Phewa	e	68	54	49	22	‡	‡	‡
Kaun Kot	f	60	48	43	19	‡	‡	‡
Matipani	g	560	336	302	101	40	‡	‡
Lamepatan	h	168	134	121	40	1	‡	‡
Argaun	i	176	221	22	11	1	‡	‡
Sisuwa	j	40	32	3	2	‡	‡	‡
Kudi	k	272	218	22	11	‡	‡	‡
Resettlement area	l	168	134	40	‡	‡	40	‡
Satmuhane	m	20	16	‡	‡	‡	‡	‡
Lower Biruwa† . .	n	32	26	23	7	‡	‡	‡
Chirgade	o	312	250	225	75	‡	‡	‡
Lamadi	p	88	70	63	21	‡	‡	‡
Dhorbehnsi	q	20	16	10	‡	‡	5	‡
Total		3,556	2,736	1,986	721	65	65	14

* Key refers to figure 6.
† Correct name unknown. Location given in figure 6.
‡ A negligible quantity.

and the planting and harvesting dates for each crop. The blank areas within the diagram represent agricultural land which is fallow for lack of water or other reasons.

Livestock Holdings

Practically every family in Pokhara has some livestock, but very few have large herds. Only the very biggest landlords have many cattle. In the sample of 125 households none were in this category. The lack of feed drastically limits the number of cattle that can be maintained. Maize stalks, rice, millet and wheat straw, and green grass cut laboriously with a sickle are the important feedstuffs. As soon as the paddy is harvested the cattle are allowed to graze the khet for gleanings and stubble. Grass is cut from hillsides, terrace banks, and from sides of the river gorges. Several varieties of trees are stripped to provide fodder.

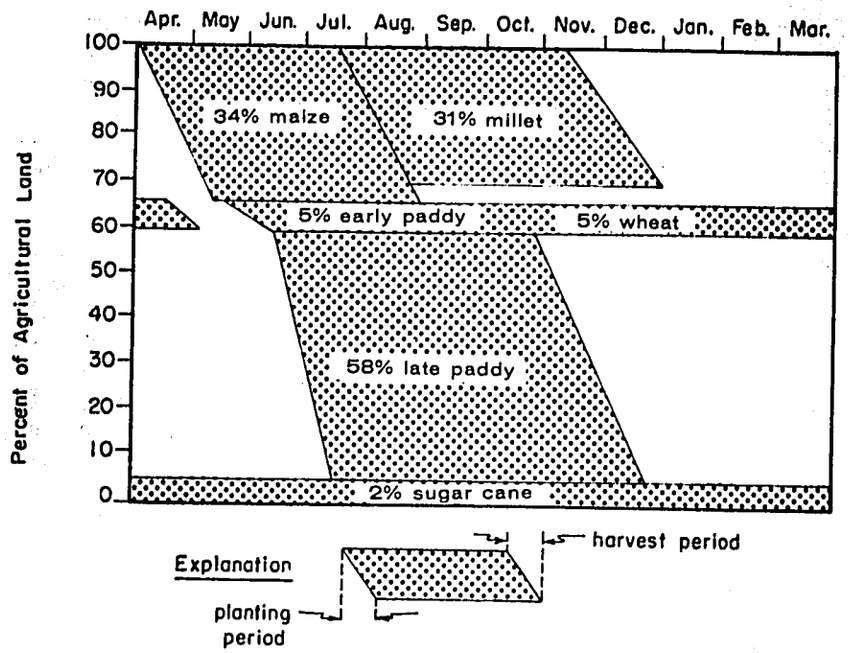

Figure 7. **Seasonal cropping pattern, Region 1.**

Many households own one bullock which will be paired with another from a neighboring household to make a team for most agricultural operations. This type of cooperation is very common within the valley.

Livestock, although few in number, do provide important high protein foods for the diet, and bullock power is the only source of nonhuman farm power now utilized by farmers in Pokhara Valley. Future numbers of livestock may be closely related to the increased planting of wheat. Because the paddy stubble is used for grazing, the fencing of khet for wheat plantings is strongly opposed by the few land owners who have large herds of buffalo or cows.

Varieties and Yields of Major Crops in 1968

Now that it has been shown how the livestock sector fits into the agricultural economy of Pokhara Valley, the yields of important grain crops will be analyzed.

Paddy

Many varieties of paddy are grown in Pokhara Valley; 24 varieties were observed while the yield was being measured.

Great variability in yield exists between varieties and between soils. In some ways perhaps these two factors tend to counter-balance each other and reduce the variability in yield. In the poor soils, a fairly coarse rice is usually grown because it yields well under adverse conditions. The best quality rice is usually grown on the best soils. Production does not increase significantly but it is of higher quality. Therefore, there does seem to be a definite tradeoff between quality and quantity.

We took a total of 85 yield samples in 1968. The method used was to travel to the khet area and ask a farmer to allow his field to be measured with a steel tape. If he agreed, a laborer was paid a day's wage to thrash the produce of that field and the paddy was weighed with a spring scale. The data is presented in summarized form in table 9. The average yield of fine paddy was 21.5 quintals per hectare. The average yield of medium and early varieties was 20.1 and 18.5 quintals per hectare respectively. The highest yields varied from 21.4 quintals in Sisuwa to 40.0 quintals in Chaadi. The lowest yields were from 4.3 quintals in Argaun (reduced by rat damage) to 14.8 in Biruwa.

For purposes of further analysis it will be assumed that all the area of khet planted to fine and medium varieties yields 20.8 quintals per hectare and that early varieties yield 18.5 quintals per hectare.[16] This

[16] Paddy yields may be converted into approximate local measures by multiplying by 0.1 to convert into muri per ropani. Thus 20.0 quintals per hectare is approximately 2 muri per ropani. 20.0 quintals/hectare x 2 muri/quintal x 0.05 hectares/ropani = 2 muri/ropani.

Table 9. Khet yields of paddy in quintals per hectare
(Pokhara 1968 – 85 observations)

Khet name and number of observations		Map key*	Variety of paddy			Sample range	
			Fine	Med.	Other	High	Low
Kali Khola	(13)	a	22.2	25.3	24.1	31.6	7.1
Phewa and Fishery	(7)	e	39.1	11.6	–	39.1	11.0
Sedi Chadi	(8)	f	–	22.2	15.6	40.0	8.6
North Kundar	(6)	l	–	20.4	18.7	32.5	10.5
Biruwa-So. Kundar	(8)	j, m	20.7	25.6	32.4	35.1	14.8
Argaun	(24)	n	18.9	19.7	24.0	38.8	4.3
Sisuwa	(4)	o	10.0	14.9	–	21.4	6.9
Satmuhane	(15)	t	33.1	19.7	16.8	35.8	13.0
Average	(85)		21.5	20.1	18.5		

* Key refers to figure 4.

simplifying assumption is justified because there seems little difference in yield between medium and fine varieties and because of the great variability in yields between fields in the same khet. Yields in Pokhara are approximately the same as the national average.

Maize

Several local varieties of maize are grown in Pokhara, and a few farmers use "American" maize introduced by the extension service. Estimating yields for maize was more difficult than for paddy because of the harvesting technique. The fields are harvested over an extended period of time as each plant matures. The ears from all the fields are mixed and it is impossible to keep the produce from one field separate. Therefore, the procedure employed was to delineate 200 square feet of a maize field where the crop appeared to be "typical" of that field. Within this 200 square feet the number of ears were counted and the length of ears was measured. This was done for 35 fields in Region 1, and 23 fields in Region 2. The maize in Regions 3 and 4 was almost totally destroyed by hail on May 29, 1968.

The number of ears of various sizes required to fill a pathi measure with shelled maize was counted. This varied substantially between Region 1 and Region 2 because of the larger diameter of ears in Region 1. The approximate yield in Region 1 was estimated at 25.09 quintals per hectare, the yield in Region 2 at 18.82 quintals and for the rest of the valley 0.68 quintals.[17] Yields in Pokhara can be expected to vary because of frequent hail and changeable weather. As an overall average yield without extensive hail damage, 18.82 quintals per hectare can be expected and will be used for projected estimates. In local measure this is approximately 1.50 muri per ropani. In 1968 the overall average yield was 10 quintals per hectare.

Millet, wheat, and cane

Several varieties of millet or kodo are grown in Nepal. They are typically differentiated by the month of harvesting or by the shape of the head, which may be either a ball (*dalle*) or extended (*jhyapay*). It has been identified as *Eleusine Coracana Gaertner* by Kihara.[18] An average yield of 11 sample fields in Region 1 was 10.19 quintals per hectare. In Region 2 a sample of 9 fields averaged 11.91 quintals per hectare. The combined sample average of 11 quintals per hectare will be used in this analysis. In local measure this is about 16.4 pathis per ropani.

Several local varieties of wheat are of relatively high quality and are hard-white wheats similar to local Indian wheats. In addition, Lerma 52,

[17] Yield of 0.68 quintals reflects severity of the hail damage.

[18] Kihara, H. (ed.). Land and crops of Nepal Himalaya, p. 69. Kyoto: Kyoto Univ. 1965.

Table 10. Wheat variety and yield
(Pokhara, 1968)

Khet name	Map key*	Number of samples	Variety & treatment		Yield
					quintals
Phalaya Phat	b	5	Local	No fertilizer	6.43
		1	L-52	No fertilizer	8.47
Baidam	c	3	L-52	No fertilizer	10.04
Argaun	g	2	L-52	No fertilizer	12.02
		1	L-52	With fertilizer	18.25

* Refers to figure 5.

a Mexican wheat of moderate straw length, is very popular. This variety is stiff strawed, medium tillering, and requires soil of average fertility. Even without fertilization, yields of this variety are greater than local varieties. In considering various alternative hypotheses in subsequent chapters, local variety yields will be assumed to be 6 quintals, improved varieties 10 without and 18 with fertilizer. The result of wheat yield sampling is presented in table 10.

Cane yields could not be accurately given by informants, but in good fields it was estimated that one ropani would yield 13.5 muris juice, and an overall average yield would be approximately 10.0 muris juice per ropani. One muri of juice yields 7 dharni gur. This is the equivalent of 3266 kilograms of gur per hectare.

Table 11. Production of crops
(Pokhara, 1968-69)

Crop	Area*	Yield†	Production
	ha	quintals/ha	quintals
Late paddy	4,080	20.8	84,864
Early paddy	756	18.5	13,986
Wheat	630	10.0‡	6,300
Maize	2,736	10.0§	27,360
Millet	1,986	11.0	21,846
Gaiya	721	10.0	7,210
Gur	65	33.0	2,145
Buckwheat	65	8.6	575

* From tables 6, 7, and 8.
† From chapter 3.
‡ Improved variety without fertilization.
§ A normal yield would be 18.8 quintals/ha had there not been severe hail damage.

Yields of dryland paddy, gaiya, and buckwheat, were estimated to be 1 muri and 0.75 muri, respectively. Thus the yields for gaiya are 10 quintals per hectare and for buckwheat 8.85 quintals per hectare.

Production Estimates for 1968

The area planted to various crops has been presented in the second and third sections of this chapter. Using these data and multiplying by the yields presented in the last section, an estimate of agricultural production of major crops was calculated. Average yields were used for each crop rather than different yields for each location. We estimate that in 1968 production of early paddy, late paddy, wheat, maize, and millet was 8486; 1399; 630; 2736; and 2185 tons, respectively. Production of gaiya, gur, and buckwheat was 721, 215, and 58 tons, respectively. These data are presented in table 11.

Chapter 4. Trade and Commerce

This chapter discusses the relationship of the Pokhara farmers to the Pokhara bazar, the relationship of the Pokhara bazar to surrounding areas outside the valley, and the relationship between Pokhara prices and those of the Terai.

Pokhara Farmers and the Market

The first concern of this chapter is the relationship of the individual household with the Pokhara market. The analysis treats the expenditures of each region separately because of the difference in the cash crops for each region.

Cash expenditure by area

Data were collected weekly on household expenditures. If the sales data were accurate, the surplus or deficit of the sum of sales plus nonagricultural income minus expenditures would be a net export or net import from the region. This statement holds true if savings are constant over the period considered. However, because of the inaccuracy of the sales data this determination of net import or export of the region cannot be calculated by this means.

The great majority of purchases were made locally. Total expenditures in the bazar (Region 5) are highest followed by Regions 4, 3, 2, and 1 in descending order. In Areas 3, 4, and 5 farmers simultaneously run

Table 12. Family expenditure by region
(125 families, Pokhara, 1968-69)

Item	Regions				
	1	2	3	4	5 (bazar)
			rupees		
Rice	184	171	100	263	282
Millet	64	22	4	44	12
Maize	85	7	12	78	13
Maize flour	36	0.2	3	3	33
Wheat	34	6	4	2	99
Pulse	30	72	106	69	72
Milk	0.7	6	21	48	34
Eggs	1.4	1	1	4	14
Meat	120	89	189	165	155
Vegetables	14	35	18	37	106
Fruit	0.4	1.4	4	5	5
Malt	21	18	21	33	10
Spice	27	63	40	75	27
Tea	7	115	40	54	35
Sugar	7	28	55	98	59
Agr. imports	3	4	4	12	3
Misc.	28	50	103	63	59
Ghee	54	161	179	119	152
Oil	61	89	41	113	140
Kerosene	25	38	46	65	45
Medicine	59	54	58	46	42
Cloth	221	192	299	152	111
Cigarettes	67	148	97	108	85
Firewood					91
Total expense	1,149	1,371	1,443	1,653	1,684
Total income	3,737	2,773	4,940	3,414	N.A.
Expenditures as percentage of income	31	49	29	48	N.A.

shops, thus distorting the data by double counting. The average family expenditure data for all 5 regions are presented in table 12. In general these data agree with the consumption data presented in Chapter II. The discrepancies that exist can be explained by the problem of the previously mentioned double counting. In Regions 2 and 4, expenditures were equal to about half of total income. Thus, between a third and a half of the total income passes through at least the local market and, therefore, the market does function as a distributor of marketable surplus. The Pokhara economy is monetized to this extent.

Pattern of Trade

The second objective of this chapter is to describe the relationships that exist between the Pokhara bazar, other areas of the Pokhara Valley, and the surrounding hills. The trade movements are complex and rather difficult to analyze but are of interest, especially as data on truck movements are fairly comprehensive.[19]

Enumerators collected data two days out of each month. The sample days were randomly selected. The data gathered by the enumerators have been multiplied by a factor of 15 to convert it to a monthly figure. Furthermore, trade for the last half of March and all of April and May was assumed to be the same as the immediately preceding 2½ months. This assumption is reasonable, since January through May is a uniformly dry season and the trails and bridges are all passable.

Where possible, a distinction was made based on the distance of the origin of goods from Pokhara bazar. Three categories of distance were considered.

Category 1. Origins that are at least several days walk from Pokhara bazar. From the north this includes Lamjung, Larkya, and Manang; from the southeast, Gorkha, Trisule, Rising; from the Terai, Narayangarh, Bhairawa, Butwal; and from the west, Baglung and Beni. These categories are identified by direction only, e.g., north, east, etc.

Category 2. Origins that are outside the valley, but within one day's walk. For example: Riman to the north; Masthan, Rupakot, Deorali to the east; Arukharka, Ramdi to the south; and Naudada to the west. These origins are described as Kaski north, Kaski east, etc., to suggest that in general they are within the Kaski District, but outside Pokhara. Kaski south as used in this manner is not correct strictly speaking because Pokhara lies at the southern edge of the Kaski district.

Category 3. Origins that are within the valley and are less than half a day's walk from the bazar.

A classification by item designated 22 commodities and a standard price used to convert physical units into value terms. The prices used in this conversion are given in the Appendix table 12. They were not adjusted seasonally but were used on all conversions in this section.

Trade with the North and West

From the far North, Category 1, the most important imports are skins, woolens, asafoetida (hing), aromatic grass used for spice (jimbu) and medicinal salts and herbs. For the Dasain holiday many northern goats (changra) are brought down for slaughter. In addition there are some imports of root crops and beans. Imports from Kaski north, Category 2, are

[19] We are greatly indebted to the District Superintendent of Police, Kaski, and to the Pokhara Byapar Sangh for supplying trade records.

paddy, wheat, livestock, bamboo goods, and vegetables. Imports from the northern valley are primarily wheat, maize, and ghee.

From the far West, Category 1, ghee is the only commodity with a significant import value. No distinction was made between North and West in distance Categories 2 and 3 because the trail north must first pass west around the Annapurnas. The important exports to the North and West are rice, sugar, kerosene, salt, cloth, and cigarettes.

The trade balance between Pokhara bazar and all points north and west is given in table 13. An important correction of the collected data was made to account for incomplete information on mule trains headed north. The exports of rice, kerosene, salt, cloth, sugar, and cigarettes were tripled. Private inquiry into the number of mule trains suggested that the sampling procedure accounted for only a third of the actual number of

Table 13. Composition and balance of trade between Pokhara bazar and points north and west

(June 1, 1968-May 31, 1969)

Item	Exports	Imports	Trade balance	
			Positive	Negative
	1000 rupees			
Rice	2,312.9†	419.2	1,893.7	
Maize	3.8	213.3		209.5
Wheat	20.5	131.1		110.6
Millet	3.8	11.7		7.9
Kerosene	319.1†	0.0	319.1	
Salt	329.8†	0.0	329.8	
Cloth	1,695.4†	0.0	1,695.4	
Ghee	15.4	211.2		195.8
Mustard oil	7.8	1.5	6.3	
Sugar	290.8†	0.1	290.7	
Vegetables	4.2	80.9		76.7
Pulse	3.0	53.1		50.1
Biscuits	18.3	0.0	18.3	
Milk	0.0	0.1		0.1
Fruit	0.3	4.2		3.9
Cigarettes*	2,918.9†	0.4	2,918.5	
Bamboo goods	1.6	44.9		43.3
Livestock	45.0	48.2		3.2
Firewood	0.0	13.9		13.9
Meat & eggs	0.8	6.8		6.0
Miscellaneous	210.2	599.4		389.2
Gasoline	0.0	0.0		
Totals	8,201.6	1,840.0	6,361.6	

* Includes matches, tea, soap, and other sundry goods.

† These export figures have been corrected to include mule traffic to the Thakola. See text for explanation.

mules headed north. The primary cause of under-reporting is the predawn departure of these trains. No adjustment was made for trade to the West, Kaski (north and west), or North valley. The imports of rice are from points relatively close to the bazar whereas exports are practically all to the far North. The positive trade balance of Rs. 6.36 million illustrates a very considerable movement of goods north and west from Pokhara bazar. Most of this trade is handled by Thakali merchants who have long experience in trading with the North. A considerable proportion of the rice trade is under contract with the government.

Trade with the East

The main imports from the East, in distance Category 1 (Lamjung, Gorkha, Rising), are rice, livestock, pulse, and ghee. Substantial quantities of bamboo goods are imported from the Northeast. Imports from

Table 14. Composition and balance of trade between Pokhara bazar and points east

(June 1, 1968-May 31, 1969)

Item	Exports	Imports	Trade balance	
			Positive	Negative
		1000 rupees		
Rice	25.8	1,405.6		1,379.8
Maize	2.0	6.0		4.0
Wheat	0.8	3.9		3.1
Millet	3.1	33.0		29.9
Kerosene	78.1	1.0	76.3	
Salt	382.4	0.0	382.4	
Cloth	134.5	30.0	104.5	
Ghee	6.8	40.9		34.1
Mustard oil	84.9	0.0	84.9	
Sugar	54.2	0.0	54.2	
Vegetables	7.3	52.2		44.9
Pulse	3.8	629.2		625.4
Biscuits	24.0	0.0	24.0	
Milk	0.0	67.7		67.7
Fruit	1.7	4.5		2.8
Cigarettes*	756.9	5.1	751.8	
Bamboo goods	0.5	51.2		50.7
Livestock	7.1	738.5		731.4
Firewood	0.0	17.8		17.8
Meat & eggs	0.5	18.6		18.1
Miscellaneous	186.9	318.7		131.8
Gasoline	0.0	0.0		
Totals	1,761.3	3,424.7		1,663.4

* Includes matches, tea, soap, and other sundry goods.

closer origins (Category 2) include rice, millet, ghee, vegetables, pulse, bamboo, livestock, and milk. From within the valley the largest imports are rice, milk, vegetables, and livestock.

The important exports to the East are similar to those to the North with the important exceptions of rice and pulse. The most important exports in descending order are cigarettes, tea, salt, cloth, and mustard oil. The origin of all these items is in the Terai or India. An itemized trade balance is presented in table 14. The movement of rice into Pokhara from the East (Rs. 1,380,000) is somewhat less than the outflow of rice to the North (Rs. 1,894,000).

One of the most significant effects of the road has been the creation of mule traffic working east from Pokhara. Trucks have replaced mules going to the South and the Thakali muleteers have been quick to develop routes to the East. Nevertheless, imports from the East exceed exports to the East by Rs. 1,663,000.

Trade with the South

Trade patterns with the South altered considerably after the road opened. Traditional mule traffic in sugar, salt, mustard oil, cloth, rice, and cigarettes was quickly displaced. The approximate composition of traffic when the highway first opened is presented in table 15. The trucks each carry 5000 kilograms or approximately 50 bags of salt, rice, or sugar. With bulky goods like cigarettes, the trucks are well below the weight limit.

Most of this early truck traffic was carrying goods under government contract. The highway opened for public use on the first of Baisak (15 April, 1968). More accurate records of truck traffic were obtained following reopening of the road in November after the monsoon. When the

Table 15. Initial truck traffic (no. of trucks per day)
Pokhara, Nepal (Feb. 15, 1968-May 15, 1968)

Item	Number truck loads		
	Feb.-Mar.	Mar.-Apr.	Apr.-May
Rice	4	11	12
Kerosene	0	3	11
Salt	30	30	51
Cloth	(by plane)	(by plane)	1
Mustard oil	0	1	7
Sugar	5	10	23
Cigarettes	(by plane)	(by plane)	3
Total trucks	39	55	108

Source: Private communication with the Pokhara *Byapar Sangh*.

Table 16. Composition of daily truck traffic
(Nov. 1968-Jan. 1969, Pokhara, Nepal)

Item	Average value per day			Average
	Nov.	Dec.	Jan.	Nov.-Jan.
	1000 rupees			
Rice	7.5	7.4	6.1	6.9
Wheat	0.3	0.5	0.8	0.6
Kerosene	10.2	6.7	3.4	6.6
Malt	4.2	2.3	6.9	4.4
Cloth	25.2	11.9	9.6	12.4
Mustard oil	12.5	4.4	4.0	5.1
Sugar	4.7	6.8	0.5	4.0
Vegetables	0.0	0.3	0.1	0.2
Pulse	1.2	0.4	0.0	0.3
Biscuits		1.1	0.1	0.6
Cigarettes	3.9	17.8	10.0	13.1
Gasoline	0.0	3.0	2.9	2.6
Average value per day (1000 Rs.)	69.7	62.5	44.3	56.7
Average number of trucks per day	6.00	7.05	6.95	6.89

Source: Compiled from Kaski District Police records.

road opened in the middle of November, an average of 6 trucks arrived each day. This increased to about 7 per day in December and January. The composition of truck traffic is presented in table 16 for the 3 months for which relatively comprehensive data were available. The fourth column presents the average daily truck traffic for the 46 days for which data were available. This column is used to estimate imports from Bhairawa in calculations for tables 17 and 18.

Over this 3-month period, cigarettes were the most valuable commodity trucked in, followed closely by cloth (evaluated at Rs. 1500 per bundle). Rice, kerosene, salt, mustard oil, and sugar also were significant imports. The average daily value of imports over this period was Rs. 56,700 or Rs. 8200 per truck. Some cigarettes, cloth, and kerosene are imported by porter from Narayangarh on the Nepalese Terai southeast of Pokhara.

From distance Category 2 there is an export surplus to the South. This is primarily the movement of cigarettes, livestock, and rice to the heavily populated hills south of Pokhara. Trade is almost balanced in distance Category 3 (south of the valley). In considering all the distance categories together the greatest negative trade balance to the South is cig-

Table 17. Composition and balance of trade between Pokhara bazar and points south
(June 1, 1968-May 31, 1969)

Item	Exports	Imports	Trade balance	
			Positive	Negative
	1000 rupees			
Rice	179.4	1,251.7		1,072.3
Maize	11.7	7.2	4.5	
Wheat	28.9	116.1		87.2
Millet	3.8	0.0	3.8	
Kerosene	8.4	1,236.3		1,227.9
Salt	19.6	793.3		773.7
Cloth	0.0	2,470.4		2,470.4
Ghee	0.0	123.8		123.8
Mustard oil	66.0	917.9		851.9
Sugar	20.2	716.6		696.4
Vegetables	7.7	40.8		33.1
Pulse	9.9	89.7		79.8
Biscuits	4.1	101.7		97.6
Milk	0.0	26.5		26.5
Fruit	0.0	11.0		11.0
Cigarettes*	1,385.1	6,435.2†		5,050.1
Bamboo goods	2.0	1.1	0.9	
Livestock	97.5	52.1	45.4	
Firewood	0.0	57.9		57.9
Meat & eggs	0.0	1.3		1.3
Miscellaneous	26.5	412.4		385.9
Gasoline	0.0	467.8		467.8
Totals	1,870.8	15,330.8		13,460.0

* Includes matches, tea, soap, and other sundry goods.
† Includes Rs. 4 million worth of cigarettes imported by air, based on importation rate in Baisakh (Apr. 15-May 15).

arettes,[20] followed by cloth, kerosene, rice, mustard oil, salt, and sugar. The only positive balance is in livestock, maize, millet, and bamboo goods. Data are presented in table 17. Total exports to the South were Rs. 1,871,000 and imports were Rs. 15,331,000. The net trade deficit to the South was Rs. 13,460,000.

[20] Import figure for cigarettes is based on imports by trucks, porter, and airplane. Quantity of cigarettes imported by plane is largely unknown, but from 15 Feb. to 15 May, 1968, monthly imports were Rs. 590,400, 530,700, and 451,300, respectively, in the last month the road was open to public transportation. Estimating air imports to continue at the rate of 450,000 rupees per month for approximately 9 months of good flying weather gives an estimate of Rs. 4,050,000. This has been rounded to Rs. 4,000,000 and included in the estimate of cigarette imports given in table 17.

Table 18. Distance and direction of trade
(Pokhara Valley, June 1, 1968-May 31, 1969)

Direction	Distance category*	Exports	Imports	Trade balance	
				Positive	Negative
		1000 rupees			
North & West					
Thakola	1	4,967.8	616.7	4,351.1	
Baglung	1	1,703.3	188.7	1,514.6	
Kaski (N. & W.)	2	1,099.3	654.3	445.1	
North Valley	3	431.1	380.2	50.8	
Subtotal		8,201.4	1,839.9	6,361.5	
East					
Lamjung	1	132.3	103.9	28.5	
Gorkha, Rising	1	495.0	1,713.5		1,218.5
Kaski (N.E.)	2	266.2	393.4		127.2
Kaski (E.)	2	306.1	384.4		78.4
Northeast Valley	3	24.8	67.8		43.0
East Valley	3	536.8	761.6		224.7
Subtotal		1,761.3	3,424.6		1,663.3
South					
Narayangarh	1	79.3	468.0		388.7
Rhairawa	1	1,369.0	14,716.7		13,347.7
Kaski (S.)	2	358.7	55.6	303.1	
South Valley	3	63.8	90.4		26.6
Subtotal		1,870.8	15,330.7		13,460.0
Grand total		11,833.5	20,595.2		8,761.8

* Category 1: 3 or more days' walk.
Category 2: 1 or 2 days' walk.
Category 3: within 1 day's walk.

In order to clarify the movement of goods by direction and distance, table 18 was prepared. The only directions of trade with a consistently positive trade balance are to the North and West. This is especially true of the further destinations (Category 1). The trade within the valley to the North (Category 3) is almost balanced. Pokhara exports approximately Rs. 6.362 million more than it imports. One-fourth of this flow is met by net imports from the East which totalled Rs. 1.663 million. The movement of rice from the East through Pokhara to the North is significant although some of the eastern rice is used by the inhabitants of Pokhara allowing rice imports from the South to continue northward.

The major negative trade balance is, of course, imports from Bhairawa

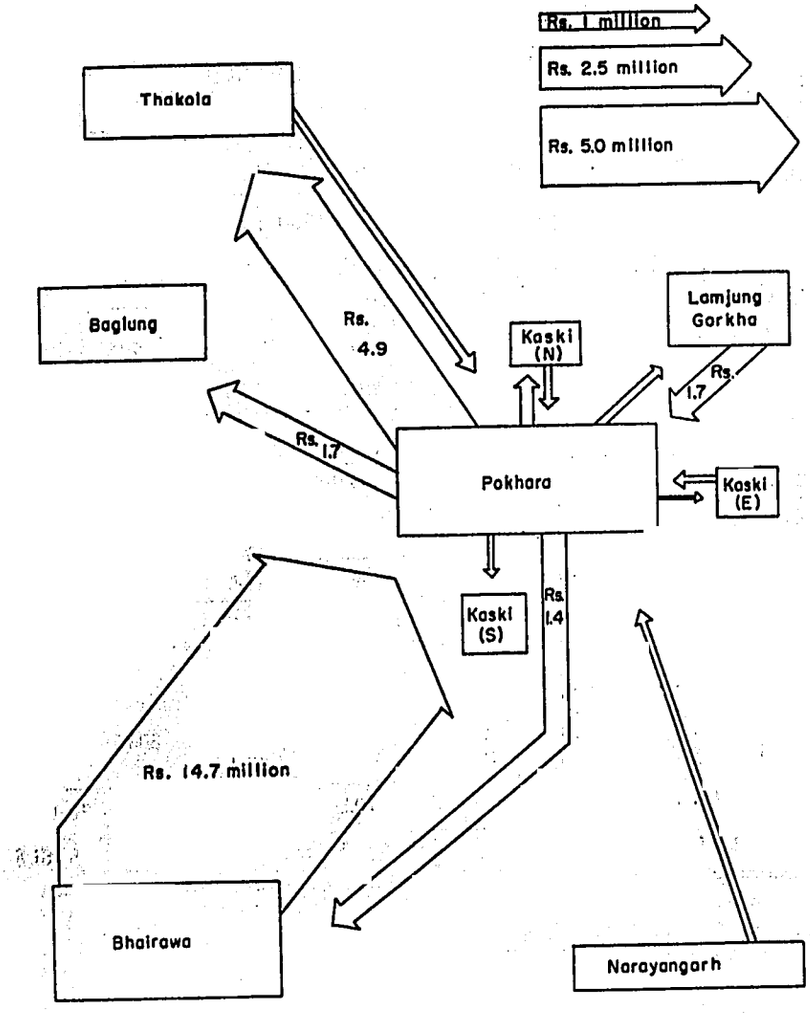

Figure 8. **Value of major trade movements through Pokhara.**
(June 1, 1968 – May 31, 1969)

on the Terai. Our estimate of an annual net trade deficit of Rs. 8.762 million for the Pokhara bazar is the best approximation for the period June 1, 1968 to May 31, 1969. This trade deficit is met largely through Gurkha remittances distributed in Pokhara.[21] Trade in cigarettes, cloth, kerosene, sugar, and sundry dry goods will be the first to diminish if a reduction in Gurkha remittance occurs.

[21] See Chapter 6 on the importance of Gurkha pensions.

The movement of goods to distance Categories 1 and 2 has been schematically presented in figure 8. The width of the arrows indicates the relative value of the goods traded. Trade within the valley has been omitted for clarity. This illustration summarizes visually the material presented in table 18 and enables the reader to visualize the direction and magnitude of trade easily.

Price Differentials and Cost of Transportation

The final concern of this chapter is the relationship of Pokhara prices to those found in the Nepalese Terai. If marketing is highly competitive and there are no institutional barriers to trade, prices in Pokhara should equal Bhairawa prices plus the costs of transportation, allowances for loss, and assumption of risk.

The effect of improved transportation on a particular commodity price in Pokhara depends greatly on its value per unit of weight. The price of low value, heavy goods, will be the most affected by the road. Salt, cement, fertilizer, and potatoes showed a significant decrease in price upon completion of the highway. Several difficulties arise in assessing the effects of the road on prices. Vegetables and potatoes have a great seasonal variation in price. Another difficulty is that Nepal revalued their currency in relation to Indian rupees on June 6, 1966. It was then devalued by 24.78 percent in relation to gold on December 8, 1967, about 19 months later. Accompanying these monetary policies were various surcharges and tariffs imposed to control speculation and restore confidence in the Nepalese rupee.

Examples of rapidly declining prices may be found in table 19. The drop in potato prices is as much due to seasonal influences as to reduced transportation costs. The sugar price rose during this period due to an increase in the Terai price. A more meaningful comparison is the price

Table 19. Prices before and after the completion of the Sonauli-Pokhara highway, 1968

Item	Road closed Dec. 15-Jan. 15	Limited traffic Jan. 15-Feb. 15	Public traffic Apr. 15-May 15
	rupees per quintal		
Rice	248	241	241
Potatoes	171	129	64
Salt	92	61	46
Sugar	347	347	450
Kerosene*	42	40	35
Ammonium sulphate	172	N.A.	119

Source: Research and Statistics Department of the Rastra Bank, Kathmandu.
* Price per 18-liter tin.

differential between Pokhara and the Bhairawa market. The price differential, unlike market prices, should not be affected by changes in the exchange rate. Before the highway was open, transportation costs separated the markets effectively. A porter carrying 37.32 kilograms (16 dharni or 1 maund) will take a minimum of 6 days from Bhairawa to Pokhara. This amounts to a transportation cost of Rs. 129 per quintal at a wage rate of Rs. 8 per day. Even if porters could be contracted for Rs. 6 per day the cost would be Rs. 96.5 per quintal. The cost of trucking is from Rs. 23 to Rs. 26 per quintal fee plus 2 or 3 rupees per quintal for local taxes, ferry charge, and miscellaneous expenses. In table 20, price differences per quintal are listed for 3 dates. The first column (Dec. 15-Jan. 15) is in the dry season, after rice harvesting and threshing, and before the Sonauli–Pokhara highway was open. The price of coarse rice in Pokhara was 74 rupees higher than in Bhairawa. Therefore, with transportation being Rs. 96 to Rs. 129 per quintal, little trade could be expected. Price differentials for many commodities are well over Rs. 100 per quintal.

The second column presents prices for the first month when the road was fully open to public transportation. Black pulse is generally grown

Table 20. Price differential between Pokhara Valley and Bhairawa
(Nepalese Terai 1968-1969)

Item	Condition of Sonauli-Pokhara highway		
	Closed Dec. 15, 1967	1st month open Apr. 15, 1968	Post monsoon Jan., 1969*
		rupees per quintal†	
Rice	74	48	79
Yellow pulse	175	23	..
Black pulse	158	–131	– 43
Potatoes	117	– 43	74
Mustard oil	232	116	– 3
Ghee	150	0	– 60
Sugar	100	– 86	41
Pepper	59	–107	35
Cummin seed	343	– 64	35
Salt	78	25	25
Milk	84	84	84
		rupees per 18-liter tin	
Kerosene	24	12	6
		rupees per 10 yards	
Janana Doti	8	– 2	2

Source: Research and Statistics Department, Nepal Rastra Bank, Kathmandu.

* Estimated by author.

† Positive numbers indicate Pokhara prices exceed Terai prices. Negative differentials indicate the reverse.

in the hills and exported to the Terai which explains the lower price in Pokhara than Bhairawa. Why pepper and cummin prices are lower in Pokhara is not known. It is probably because of errors in price reporting. The size of the price differentials has been reduced for most commodities, but the prices still have not settled down to a definite relationship.

The third column gives the price differential for the same period as column 1, but a year later when the road was fully open. The price differential of most traded items is about 25 to 45 rupees per quintal. Potato and rice differentials are significantly higher than this and help explain the considerable movement of these items from Bhairawa to Pokhara. Black pulse and ghee are exported from Pokhara. Most of the ghee is flown to Kathmandu.

The progressively lower margins from columns 1 through 3 indicate that the markets are now definitely becoming more closely related. As merchants become aware of the magnitude of demand for imported items, one can expect the margins to become even more standard. Commodities, like rice, with many qualities and taste preferences may continue to show inconsistencies due to noncomparability of the item. However, provided there is no strict market regulation, the price differentials should represent closely the cost of transportation and payments for risk, loss, and services. It should be mentioned, however, that in times of shortage, the government regulates the prices of rice, sugar, salt, and kerosene. Thus, during these periods, the prices do not represent equilibrium; free-market prices and the price differential will depend on government fiat.

Significant price differentials between Pokhara and the Terai have existed for a long time. Data on rice prices are presented in table 21. Price differentials have been particularly large from the 1963-1964 dry season until the 1967-1968 crop was harvested. Now that the road is completed, the margin of Rs. 40 to 60 is unlikely to be exceeded.

Pokhara prices have also been affected by changes in the exchange rate. On June 6, 1966, the Nepalese rupee appreciated by 37 percent in relation to the Indian rupee. Where previously Rs. 160 Nepalese could purchase Rs. 100 Indian now only Rs. 101 Nepalese are needed. This caused prices of wheat flour, salt, spice, kerosene, and cloth to decline. The price of sugar, however, increased. When on December 8, 1967, Nepalese currency was devalued by 35 percent to the rate of Rs. 135 Nepalese equaling Rs. 100 Indian, prices for these items could have been expected to increase. Only wheat flour, spice, mustard oil, and cloth prices increased, however, and even these did not increase by a large amount because of the expectation of the opening of the highway. Changes in import duties and ad valorem taxes also tended to damper the price effects of devaluation.

Now markets are irrevocably connected and price differentials that exceed Rs. 40 per quintal should stimulate the quick movement of these

Table 21. Rice prices Pokhara and Bhairawa
(1961-62 to 1968-69)

Year	Season*	Pokhara	Bhairawa	Price differential
		rupees per quintal		
1961-62	Wet	161	86	75
	Dry	138	81	57
1962-63	Wet	147	90	57
	Dry	134	88	46
1963-64	Wet	184	99	85
	Dry	227	87	140
1964-65	Wet	239	96	143
	Dry	202	93	109
1965-66	Wet	239	148	91
	Dry	235	160	75
1966-67	Wet	230	136†	94
	Dry	239	137†	102
1967-68	Wet	262	145	117
	Dry	245	181	64
1968-69	Wet	250	188	62
	Dry (5 mos.)	230	189	41

Source: Research and Statistics Dept., Nepal Rastra Bank, Kathmandu.
* Wet season: June 15-Sept. 15.
Dry season: Sept. 15-June 15.
† Corrected estimates of Rastra Bank data.

goods to the higher priced market.

This chapter has explained the relationship of the farmer to the bazar, and the bazar to the Terai and other areas. The next chapter discusses how these relationships will change as a result of the altered economic forces associated with lowered transportation costs.

Chapter 5.

Economic Effects of Improved Transportation

The effects of improved transportation on the economy of Pokhara are significant but difficult to quantify because of their development over time. This chapter first contains a discussion of the short run effects primarily assocated with a change in prices. Secondly, the longer run effects

of supply adjustment and changes in the size and distribution of personal income will be calculated. Finally, the chapter will estimate the growth of traffic on the highway.

Short- and Medium-Run Effects

Price analysis leads one to expect a rapid decline in certain prices to have two effects. First, more of the cheaper items will be consumed because they will substitute for the expensive items. Second, the lower prices have the effect of increasing the consumer's income because he can buy more of all goods following an overall decrease in prices.

In analyzing the effect of lowered prices on consumption, there are several complicating factors. Change in the exchange rates, government

Table 22. Estimated effect of an increase of income on family expenditures (Pokhara Bazar, Nepal)

Item	Avg. family expenditure Region 5	Income effect of Rs. 50	Price on April 15, 1969	Value of increment
	Rs.	kg	Rs./kg	Rs.
Rice	282	2.40	2.62	6.3
Millet	12	.60	1.06	.6
Maize	46	1.25	1.32	1.7
Wheat	99	.29	1.90	.6
Pulse	72	.31	2.18	6.9
Milk	34	.57	1.91	1.1
Ghee	152	.12	11.32	1.4
Oil	140	.02	6.70	.1
Salt	10	.10	.49	.1
Sugar	59	.32	5.41	1.7
	liters	liters	Rs./liter	
Kerosene	45	.18	2.11	.4
	Rs.	Rs.		
Meat	155	.78		.8
Eggs	14	.06		.1
Fruit	5	N.A.		N.A.
Vegetables	106	.30		.3
Tea	35	.41		.4
Cigarettes	85	.65		.7
Cloth	111	4.12		4.1
Medicine	42	0.0		0.0
Agr. implements	3	N.A.		N.A.
Firewood	91	N.A.		N.A.
Miscellaneous	59	N.A.		N.A.
Total	1,684			27.3

control of certain prices, changing import taxes, and seasonal variation all serve to complicate the analysis of price. Also the high percentage of consumption of home-produced items limits the usefulness of traditional price analysis.

The method employed in this study is to use the marginal propensity to consume for estimating the increase in expenditure of the "average" family when income is increased. The previous chapter concluded that the major consequence of the road on prices has been to reduce the price spread between Bhairawa and Pokhara. Within the range of this price spread, fluctuations will occur according to the supply and demand conditions of the local market. The income effect of reduced prices would be distributed in proportion to the marginal propensity to consume.

As an example, the effect of an additional Rs. 50 income to the average household expenditure in Region 5 is given in table 22. The average family expenditure in the bazar is presented in the first column, followed by the added consumption of major items estimated from the marginal propensity to consume. (See tables 2 and 3.) The physical quantities were priced at levels that were current after the opening of the highway. The major items whose consumption would increase because of higher income are pulse, rice, and cloth. If the increment in consumption were met entirely through purchases, an increase of Rs. 50 to family income would increase expenditure on rice by Rs. 6.3. Similarly expenditures on pulse, cloth, and sugar would be Rs. 6.9, Rs. 4.1 and Rs. 1.7 respectively. A total of Rs. 27.3 would be spent on the items in table 22. The remaining Rs. 22.7 (45%) would be primarily spent on gold, housing, and livestock, reaffirming that there is no aggregate shortage of food staples as discussed in Chapter 2. An increment in income of Rs. 50 was used in this example because it is expected that real incomes will rise by 1.8 percent per year (see Chapter 6). For the "average" household with an income of Rs. 2884, the increase in income for the first year is approximately Rs. 50.

Long-Run Effects

Supply response of major crops

The most significant effects of improved transportation and communication will be of a long run nature. It is important to anticipate the economic and institutional changes associated with a new agricultural technology in order to speed the process of development and assure that regional income is augmented, not depressed, by exposure to the Terai markets.

We believe that the pattern of cropping in Pokhara will change gradually. New varieties of fertilizer-responsive rice will be planted in the valley. This will occur first in the soils where the local early rice, Tauli, is presently planted. These soils are well drained, the quality of new

varieties is similar to that of Tauli, and the harvest season is approximately the same.

The total paddy land in Pokhara is 4836 hectares, and 15.6 percent or 756 hectares are presently planted to early rice (table 6.). For purposes of estimation we assumed the yields and responses to nitrogen presented in table 23. These estimates are based on research undertaken at the International Rice Research Institute and reported in their annual report for 1967.[22] It is assumed that the Nepalese local varieties do not respond positively to nitrogen but lodge with fertilizer application as does Peta, a Philippine indica rice. The yield of Chainung 242 is assumed to be the same as Taichung Native 1 which it resembles. The improved fine variety, yet to be discovered, is assumed to have the same response characteristics as IR5.

The projections of production presented in table 24 are optimistic, given the uncertainties and difficulties encountered in introducing new techniques and varieties. At the same time these projections could serve

[22] IRRI 1967 Annual Report, table 3, p. 155.

Table 23A. Results of field trials by International Rice Research Institute (IRRI 1967, wet season)

Nitrogen applied	T(N)1	IR8	IR5	Peta
kg/ha	quintals/ha			
0	25.1	33.9	39.5	25.9
20	32.3	40.1	44.1	22.0
40	35.4	43.2	47.0	22.4
60	37.8	44.7	51.7	15.1

Source: IRRI 1967 Annual Report, table 3, p. 155.

Table 23B. Estimated effect of nitrogen on paddy yields of different rice varieties in Pokhara, based on field trials by the IRRI

Variety	Nitrogen applied		
	0 kg/ha	20 kg/ha	40 kg/ha
Early			
Tauli	18.5		
Chainung	25.1	32.3	35.4
Late			
Local	20.8		
Improved	39.5	44.1	47.0

as a rough goal for the extension service, and other institutions involved in change. It is assumed that 25 percent of the late paddy land will be shifted into new varieties in 5 years, and 50 percent in 10 years. The use of fertilizer is assumed to lag behind the introduction of new varieties,

Table 24. Projections of paddy production and fertilizer use
(Pokhara Valley, 1973, 1978)

Crop and treatment	Yield data	1968	1973	1978
Late rice:				
Local variety	area (ha)	4,080	3,060	2,040
0 kg N/ha	yield (q/ha)	20.8	20.8	20.8
	production (M.T.) . .	8,486	6,365	4,243
Improved variety	area (ha)	0	760	1,020
0 kg N/ha	yield (q/ha)		39.5	39.5
	production (M.T.) . .		3,002	4,029
20 kg N/ha	area (ha)	0	260	760
	yield (q/ha)		44.1	44.1
	production (M.T.) . .		1,147	3,352
40 kg N/ha	area (ha)	0	0	260
	yield (q/ha)			47.0
	production (M.T.) . .			1,222
Total produc. late paddy (M.T.)	. . . . .	8,486	10,513	12,846
Requirement amm. sulph. (M.T.)	. . . . .	0	26	128
Early rice:				
Local variety	area (ha)	756	378	95
0 kg N/ha	yield (q/ha)	18.5	18.5	18.5
	production (M.T.) . .	1,399	699	176
Improved variety	area (ha)		283	283
0 kg N/ha	yield (q/ha)		25.1	25.1
	production (M.T.) . .		710	710
20 kg N/ha	area (ha)		95	283
	yield (q/ha)		32.3	32.3
	production (M.T.) . .		307	914
40 kg N/ha	area (ha)			95
	yield (q/ha)			35.4
	production (M.T.) . .			336
Total produc. early paddy (M.T.)	. . . . .	1,399	1,717	2,137
Requirement amm. sulph. (M.T.)	. . . . .	0	10	47
Total paddy produc. (M.T.)	. . . . .	9,885	12,230	14,982
Total amm. sulph. required (M.T.)	. . . . .	0	36	175

so that in 5 years only a quarter of the acreage planted to the improved variety will be fertilized. This slow rate of adoption is assumed because of the total lack of knowledge concerning fertilizer use. The vast majority of Pokhara farmers have no experience in the use of inorganic fertilizers. It is assumed that after 10 years, half the acreage sown to the improved variety is fertilized. Total production of late rice increases by 23.9 percent in the first 5 years and by an additional 22.2 percent in the second 5 years. Use of ammonium sulphate increases from 26 metric tons after 5 years to 128 metric tons after 10 years.

Early paddy lands are assumed to be planted to new varieties at a faster rate. After 5 years it is assumed that half the land is planted to new varieties such as Chainung 242, and after 10 years, only 12 percent of the land remains in local varieties. Given these assumptions, paddy would increase from 1399 to 1717 tons or 22.7 percent in the first 5 years and to 2137 or 24.5 percent after 10 years.

Total rice production, both early and late paddy, increases from 9885 to 12,230 tons in 5 years. After 10 years, production would be 14,982 tons. This increase in production is the equivalent of a 4.2 percent annual growth rate. If rice production were to increase at only half this rate, the rise would just keep pace with the expected growth of population. The total ammonium sulphate requirement to maintain a growth rate of 4.2 percent would be 35.5 metric tons after 5 years and 175.3 metric tons after 10 years.

The ratio of nitrogen and rice prices is favorable in Pokhara. The price of 1 kilo of nitrogen is Rs. 5.95 and 1 kilo of rice at harvest is Rs. 2.40, making the ratio 2.5:1.

Farmers' gross returns to adopting new varieties and fertilizer are higher compared with returns to local varieties without fertilizer, indicating that it would be quite profitable to shift. For example, if the local paddy yields 20.8 quintals at Rs. 140 per quintal, the gross return per hectare is Rs. 2,912. If switching to a new variety increases the yield to 39.5 quintals at Rs. 130 per quintal, gross return has increased by 76 percent to Rs. 5,135 per hectare. The price of the new variety is discounted because of taste preference for the local variety. Use of 20 kilograms of nitrogen would increase gross revenue by Rs. 479 at a cost of Rs. 119 for fertilizer. This ratio of 4:1 is highly favorable. An additional 20 kilograms of nitrogen would increase gross revenue by Rs. 258 or a ratio of over 2:1. The switch to new varieties does entail a large increase in harvesting costs because the traditional threshing method is ineffective with the new varieties tested in Nepal. Development of effective, inexpensive, portable, and simple threshing machines may play an important part in popularizing the new varieties.

There have been some promising results with "synthetic" varieties of maize in the Terai. Within 10 years it should be possible to introduce new varieties of maize to Pokhara. However, yields are already quite high

in properly fertilized fields. The shortage of farmyard manure is a limiting factor at present, but with the advent of chemical fertilizer it should be feasible to achieve significant increases in yield. Approximately 2736 hectares of land are presently planted to maize and should yield about 18.8 quintals per hectare if not damaged by hail storms. If application of 40 kilos nitrogen and 20 kilos phosphorus increased yields from 18.8 quintals to 26 quintals of maize per hectare, the ratio of the increment of gross revenue to fertilizer cost would be 2.3 to 1 which is quite favorable.[23] This implies a response of 12 kilograms of product per 1 kilogram of fertilizer nutrient. However, if fertilizer response is 8 kilograms maize per 1 kilogram plant nutrient, the returns would be much less. This ratio is typical in India and leads to an added return of Rs. 576 for a fertilizer cost of Rs. 369 or a payback of Rs. 1.56 for each rupee invested in fertilizer. This return would be too low to stimulate a strong demand for fertilizer. We assumed that a new variety suitable for Pokhara will be found and that it will be highly responsive to fertilizer. The projection presented in table 25 assumes that after 5 years 20 percent of the maize area will be commercially fertilized at the average rate of 40 kilos nitrogen and 20 kilos of phosphorus per hectare. It is assumed that the area thus fertilized would have an average yield of 26 quintals per hectare. After 10 years it is assumed that 50 percent of the maize land would be fertilized in this way. Production would increase from 5144 tons to 5538 tons in 5 years, and up to 6129 tons in 10 years. Fertilizer requirements would be 109 metric tons of ammonium sulphate and 68 metric tons of superphosphate (16 percent) in 5 years. After 10 years, 274 tons of ammonium sulphate and 171 tons of superphosphate would be needed. The average annual increase in maize production would be 1.7 percent per year. This rate of growth is less than for rice because yields are already higher, and new varieties have not yet been tested in Pokhara under farm conditions.

There is more potential for increase in wheat production than for either rice or maize. It is assumed that much of the land now planted to paddy only will be double-cropped with wheat. There were 1167 hectares of potential wheat land unused in Pokhara in 1968. By 1973, half of this land could be in wheat yielding 10 quintals per hectare, and all the land presently in wheat should be yielding 20 quintals per hectare. After 10 years, 90 percent of the total potential wheat land could be producing 20 quintals per hectare. Moderate fertilization of 24 kilos nitrogen, 8 kilos phosphorus, and 8 kilos potassium would probably be needed. This could be supplied by importation of 50 tons of ammonium sulphate and 34 tons of nitro-phoskar (15:15:15). After 10 years, the requirement would be 129 tons and 86 tons, respectively, for these two types of fertilizer. Pro-

[23] Nitrogen, Rs. 5.95 per kg., phosphorus, Rs. 6.53 per kg., maize, Rs. 120 per quintal.

Table 25. Projections of maize and wheat production and fertilizer use (1973, 1978)

Crop and treatment	Yield data	1968	1973	1978
Maize:				
0 kg fertilizer	Area (ha)	2,736	2,189	1,368
	Yield (q/ha) . .	18.8	18.8	18.8
	Produc. (M.T.) .	5,144	4,115	2,572
Fertilized with 40:29:0 per/ha	Area (ha)		547	1,368
	Yield (q/ha) . .		26	26
	Produc. (M.T.) .		1,422	3,557
Total maize produc. (M.T.)	. . . . .	5,144	5,538	6,129
Requirement amm. sulph. (M.T.)	. . . . .		55	137
Requirement of ammo-phos. (20:20:0) (M.T.)	. . . . .		55	137
Wheat:				
Lerma 52, 0 kg fertilizer	Area (ha)	630	584	180
	Yield (q/ha) . .	10	10	10
	Produc. (M.T.) .	630	584	180
Lerma 52, fertilized with 24:8:8 per ha	Area (ha)		630	1,617
	Yield (q/ha) . .		20	20
	Produc. (M.T.) .		1,260	3,340
Total wheat produc. (M.T.)	. . . . .	630	1,844	3,520
Requirement amm. sulph. (M.T.)	. . . . .	2.1*	50	129
Requirement 15: 15:15 (M.T.)	. . . . .	1.5*	34	86
Requirement 20:20:0 (M.T.)	. . . . .	4.3*	0	0

* Fertilizer sales for 1968-69 wheat program provided by Pokhara branch of Agricultural Supply Corporation.

duction of wheat should increase from 630 tons in 1968, to 1844 tons in 1973, and 3520 tons in 1978. This is an average annual growth rate of 18.8 percent. Considerable fencing, dry-season irrigation, and help from the extension service would be required to attain this rate of growth.

Lack of information prevents making projections of other crops and fertilizer use. As the man-land ratio rises, the intensity of farming will increase, thus augmenting production. An annual increase of 1 percent for noncereal agricultural crops will be used for the purposes of projection. Cane production could be greatly increased with fertilizer use, but with the completion of the road and the importation of refined sugar the de-

mand for gur will be weak. Fertilizer can be used with good results on vegetables such as cauliflower, cabbage, potatoes, and onions. These are generally grown in plots adjacent to the house and usually receive heavy applications of farmyard manure. If commercial vegetable farming develops, a substantial amount of fertilizer might be used in these enterprises. In 1968 a handful of farmers who were growing vegetables primarily for the market used fertilizer and insecticides. The response of millet (kodo) to fertilizer is unknown.

A summary of crop projections and fertilizer requirements is given in tables 26 and 27. Annual growth rates for paddy, maize, and wheat are 4.2 percent, 1.7 percent, and 18.8 percent, respectively. The very low bases of fertilizer use in 1968 will cause the annual rate of increase to be very high initially, but in the second 5 years, an annual increase in fertilizer use of 20 to 24 percent will meet the requirements. In table 27 the requirements are given both in terms of elemental nitrogen, phosphorus, and potassium as well as in fertilizers now available in Nepal. The three fertilizer formulations given in the table are only representative of the many ways to provide the required quantities of the basic plant nutrients.

Other input requirements are insecticides, fungicides, and new seed. The actual, required tonnage of these chemicals will not be large; the difficulty will be in teaching farmers to use them safely and effectively and to distribute and apply them at the proper time. Because of the difficulty of doing this with the limited extension staff, use of these chemicals will probably not be widespread for some time. This is one reason that rates of fertilizer applications will probably remain low. Heavy fertilizer applications usually require careful chemical control of pests and diseases to prevent serious crop damage. Import of new seed will continue to be necessary as new varieties are developed and tested. A paddy seeding rate of 4 to 5 mana per ropani in local measure is the equivalent of 25 to

Table 26. Summary table of cereal crop projections (1973, 1978)

Crop	1968	1973	1978	Avg. annual growth rate
	1000 metric tons			percent
Paddy*	9.89	12.23	14.98	4.2
Maize†	5.14	5.54	6.13	1.7
Wheat†	.63	1.84	3.52	18.8
Millet‡	.18	2.18	2.18	.0
Gaiya‡	.72	.72	.72	.0
Buckwheat‡	.05	.05	.05	.0

* From table 24.
† From table 25.
‡ From table 11.

Table 27. Summary table of fertilizer requirements

Plant nutrients or fertilizer	1968*	1973	1978	Average annual rate of growth 1968-73	Average annual rate of growth 1973-78
	metric tons			percent	
Nitrogen 100%	1.51	44.10	128.52	95.4	23.9
Phosphorus 100% . . .	1.09	15.98	40.30	71.1	20.3
Potassium 100%	.23	5.04	12.94	85.4	20.8
or					
Ammonium sulphate 20:0:0	2.10	140.60	441.10		
Ammosphos 20:20:0	4.30	54.70	136.80		
Nitrophoskar 15:15:15	1.50	33.60	86.24		

* Sales reported by the Pokhara Branch of the Agricultural Supply Corp. Fertilizer sold for use in 1968-69 wheat program.

31 kilos of seed per hectare. Thus 3 tons of seed would be required to plant 100 hectares of land. Presumably if the new variety were successful, the crop would be harvested for use primarily as seed, and thus spread rapidly.

This has been the case with Lerma 52 wheat which has sold at a premium price for seed in spite of its lower eating quality. In fact, distribution of this variety by the extension service dropped by 80 percent in one season, although the acreage planted to it increased significantly. The seed produced by farmers in 1968 was sold directly to others, bypassing the extension service. This dramatically demonstrates the need to encourage confidence and trust between the extension service and the farmers to prevent further erosion of the cooperation between these two groups. The extension service must be upgraded to provide the necessary services if the agricultural sector is to contribute to rising incomes.

Income redistribution

One of the effects of the highway may well be a redistribution of income within the valley. The two primary causes are: differential supply responses between regions of the valley and changes in prices received for the marketable surplus. Although from 65 to 75 percent of total income is derived from agriculture, each region differs significantly in the combination of grains it produces (see table 4). An example of the effect of regional income redistribution may be illustrated as follows: If crop production expands at the annual rates projected in table 26, the increase in household agricultural incomes will be 1.35 percent for Region 1, and 2.39 percent for Region 4. Thus in 10 years' time a household in Region 1

will have its agricultural income increased by approximately 15 percent, whereas in Region 3 the increase will be close to 47 percent. Assuming household size and landholdings to remain constant, Regions 3, 4, 2, and 1 would be benefited in descending order by improved technology. The contribution of the cereal grains to the growth of agricultural income is shown in table 28.

It is unlikely, given the rate of population growth and production increase, that supply will increase fast enough to depress prices significantly in the bazar. The demand for grains in Pokhara and in regions to the north clearly do not have low elasticities. Because year-to-year variations in supply due to weather conditions will screen the effect of gradual production increases on market price, the price effect is ignored. A significant proportion of the production increase will be consumed within the household especially in Regions 1, 2, and 4 where per capita incomes are quite low. In years of short supply, the high prices associated with shortages in previous years probably will not occur because it is possible to import grains from the Terai.

Impact on trade

The long-run change in trade pattern is difficult to predict. The change in consumption caused by rising or decreasing incomes has been discussed as a medium term effect of the highway (see table 22). The importation of new inputs used in the production process will become an important

Table 28. Contribution of increased cereal production to growth of agricultural income

Crop	Annual production increase°	Crop components of growth rate by region†			
		1	2	3	4
			percent		
Faddy	4.2	.840	1.806	2.520	2.310
Maize	1.6	.323	.204	.051	.034
Millet	0.0	.000	.000	.000	.000
Wheat	18.8	.188	.376	1.316	.940
Income growth rate		1.351	2.386	3.887	3.287
Income growth adjusted for 2% population growth		–.649	.386	1.887	1.287

° From table 34.
† Income components of table 7 multiplied by the annual production increase (column 1).

part of the trade pattern. For example, after 5 years, 140 tons of ammonium sulphate and 88 tons of other complex fertilizers will be required. Thus, about 46 truckloads per year of fertilizer will be needed, assuming that truck size remains constant at 5-ton capacity. The movement of cereal grains to the north will gradually increase as technological change affects production per capita in Pokhara and in the Terai.[24] The trade in light consumer items manufactured in India is likely to increase because of improved communications and heightened awareness of the variety of goods available in Indian markets. The capacity, however, to purchase these items will be determined to a large extent by the long-term availability of cash remittances from Gurkha pensions. Incomes in the bazar (Area 5), will increase primarily through the greater volume of goods traded. If Pokhara continues to grow as a trade center for much of western Nepal, incomes in the bazar should also increase.

Chapter 6. Additional Components of Development

This chapter briefly enumerates several unconnected but important factors that must be considered in any regional development plan for Pokhara.

Population Growth

The rate of population growth in Pokhara as a region will obviously affect per capita income levels. The growth rate in Nepal as a whole is predicted to be 2 percent from 1965 through 1970, 2.2 percent from 1970 through 1975, and 2.4 percent after 1975.[25] A growth rate of 2 percent is used in this study but it may well underestimate actual growth. The age composition of the population is pyramidal, with close to 40 percent of the population under 15 years of age. This age structure leads to a high ratio of dependents to the productive labor force and a rising proportion of child-bearing women in the total population.[26]

Besides the natural growth of population within Pokhara Valley there are 3 major sources of shifting population. First are the employment possibilities in the Nepalese Terai, in Indian industry, and in the Indian and British armies. Some of the work force does emigrate to the plains for

[24] Estimates of cereals available for export in 1973 and 1978 are presented in tables 36 and 40.

[25] National Planning Council, Ministry of Economic Planning. The third plan, p. 14. Kathmandu: His Majesty's Government. 1965.

[26] International Bank for Reconstruction and Development. Finance and Development, 6(4):48. Dec. 1969.

temporary or sometimes permanent service. A second factor is the immigration of the hill tribes into Pokhara. A long-term decline in Gurkha remittances and pensions would deprive many hill villages of their economic base. The population would then migrate to the valleys and perhaps to the plains. A third factor is the inability of the northern people, primarily Bhotias and Thakalis, to carry on trade with China. If this traditional trade is interrupted, as it has been in recent years, these traders will have to migrate south, many to Pokhara. Between 1962-63 and 1968-69 the Bhotia population increased significantly. The inability of these people to supplement their agricultural income with income traditionally derived from trading expeditions into Tibet is the main cause of their migration.

Industrialization and Tourism

It is unlikely that appreciable industrialization will occur in Pokhara for some time. There are many other regions in Nepal that offer a more desirable location, larger workforce, and larger markets. However, certain agriculturally oriented businesses may prosper in Pokhara. Food processing industries such as milling and baking already exist. Several shops servicing bicycles and other vehicles have sprung up since the completion of the highway, and more small industries servicing the transportation sector will develop. Slate is marketed in Pokhara, and it is conceivable that with proper grading and selection, it would be profitable to export this material.

Perhaps one of the most potentially valuable natural resources is Pokhara Valley's scenic location. Tourism may well become a very important factor in the development of the valley. At present the major effect of tourism on the region is the employment of hotel servants and laborers for hotel construction. Much of the food consumed at the hotels is imported from Kathmandu, and some hotels are owned by Kathmandu residents. Very few local resources or local personnel have been utilized in the tourist industry at its present stage of development. In 1968 there were 3 or 4 small hotels at the airport offering various degrees of service, and one luxury hotel under construction on the lake.

One major obstacle to increased tourism is the difficulty in obtaining air passage to and from Pokhara. This is a heavily travelled route, and tourists often are unable to obtain reservations on short notice. A second difficulty is the problem of supplying the hotels with high-quality meats, vegetables, and other food products. There is potential for a successful business in supplying these needs. Until such businesses develop, the opening of the road should ease the supply problem of the hotels in Pokhara. A third limitation of the Pokhara area at present is the lack of organized expeditions, entertainment, and recreational facilities. This void could and probably will be quickly filled as local entrepreneurs become

aware of the potential market. At the annual meeting of the Pokhara Byapar Sangh in 1968-69, the need to provide these facilities was repeatedly stressed in speeches to the business community.

Gurkha Pensions and Remittances

Traditionally Pokhara has been a major recruiting center for the Gurung and, to a lesser extent, the Magar tribes into the British Gurkha regiments. Nepalese battalions were offered to the British by Jung Bahadur Rana, the prime minister, to assist in putting down the Indian Mutiny of 1857. After India's independence the Gurkha regiments were divided between the Indian army and the British army. At present the British Gurkhas have been largely pensioned off although a few remain in Malaysia and Hong Kong.

Remittances to these troops are an important source of income to Nepal, and an especially important source of income to the hill areas where lack of proper technology has hindered the progress of agricultural development. In 1967-68 Gurkha remittances totalled Rs. 38.6 million for the country as a whole. For the first three quarters of 1968-69 they totalled Rs. 33.3 million.[27]

In Pokhara, pensions are distributed to about 15,000 soldiers, 10 percent of whom are in the British Army and 90 percent in the Indian Army. Specific information on Gurkha payments was apparently available only to those officials responsible for planning the development of the valley. Therefore, assuming the average yearly pension to be Rs. 500, the total annual disbursement in Pokhara amounts to Rs. 7.5 million per year. This is the major source of financing the trade deficit discussed in Chapter 4 (table 18). In any projections of future income, the size of future payments should be accurately ascertained. For purposes of this analysis, payments will be held constant at the above-mentioned rate.

Institutions Required for Development

Since the overthrow of the Rana regime in 1950, Nepal has developed many new institutions.

Local government (gaun panchayat)

The gaun panchayat is a board of representatives elected to deal with local issues. Some of the local (gaun) panchayats have been very successful in contributing to the welfare of their electorate. At present the great variability in the quality of leadership makes the future of these institutions uncertain, but they will probably become more effective as the electorate realizes the value of good leadership.

[27] Research and Statistics Department, Nepal Rastra Bank. Quarterly Economic Bulletin 3: July 1969.

The panchayat does have an important role to play in agricultural development. Organization of the community to fence paddy areas so that wheat can be grown in the winter season is one prerequisite to the increased wheat production postulated in Chapter 5. Distribution of new varieties of seed, fertilizer, and other inputs could be greatly facilitated by cooperation between the panchayats and the extension service.

The Extension Service

This branch of the Agricultural Department is faced with a difficult challenge in Pokhara. In the past, the "improved practices" have not been particularly well adapted to Pokhara. Consequently few farmers have shown interest in the work of the extension service. With the drastic reduction in fertilizer prices and with the new varieties of fertilizer-responsive wheat and rice, the extension service for the first time has an opportunity to provide real benefits to the farmer. Their ability to perform the educational and distributive functions will depend to a great extent on the motivation and skills of the personnel. Since Pokhara has been selected as one of the regions for intensive development efforts, the personnel assigned to the valley should be highly motivated, experienced, and skillful.

Land Reform Office

The most important function of the Land Reform Office is to control the level of rent payment (set at 50 percent of the main crop) and to collect and disburse compulsory savings. The purpose of compulsory savings is to increase the rate of savings of the agricultural sector, and to provide a source of capital for investment in agriculture. Payment to the Land Reform Office can be made in cash or kind at values set by a committee formed of the panchayat chairman, zonal commissioner, and land reform officer. In 1966-67, Rs. 22,000 and 728 tons of paddy[28] were collected. In 1967-68 compulsory savings were not collected. In 1968-69 a total of Rs. 13,000 had been collected in the first 9 months. The rate of collection was Rs. 1.0 per ropani, or Rs. 20 per hectare. Interest is paid to the farmer and he may also borrow for consumption against his deposits. This function duplicates the Agricultural Development Bank which loans primarily through cooperative societies.

Cooperative societies and the Agricultural Development Bank

There is insufficient experience to comment in detail on the functioning of the cooperative societies. In 1968 many of them were not functioning well. Several cooperatives want to borrow money to run a consumer store, but it seems unlikely that they will be able to compete successfully with the established business communities in this venture. To obtain an agricultural loan, a farmer must join a cooperative. The cooperative must

[28] Actually, 14,500 *muris* of unspecified grain were collected. This has been converted to paddy equivalent.

then show repayment capacity. It must also find a junior technical assistant to draw up farm plans that must be approved by the district agricultural development officer (DADO). The approved farm plan is then re-approved by a sub-inspector of land reform and then the manager of the bank. The delays and complications of obtaining all these approvals discourage many applications for credit.

Storage facilities and feeder roads

As the valley develops, there may be a demand for off-farm storage. It is particularly likely that a wheat–maize–fertilizer storage facility would be appropriate in Argaun. Wheat losses can be high under improper storage conditions, and if the projected increase in wheat production is achieved, a storage facility near the major producing area would serve a useful function. Approximately 490 hectares (78%) of wheat was grown east of the Bijayapur River. In this area an additional 718 hectares may be planted to wheat. Cultivation of this additional land, coupled with a doubling of the yield by fertilizer application, will strain on-farm storage capacity. In addition, proper storage facilities for fertilizer would expedite its use in this part of the valley.

For example, if in 1978, 67 percent of the projected wheat acreage is east of the Bijayapur River, then 86 tons of a complex fertilizer like nitrophoskar would be needed.[29] Here, 67 percent of the production would be 2358 tons. Two 500-ton godowns would probably handle all the off-farm storage required. Because of expensive building costs in Pokhara and the high opportunity cost of capital, they should not be constructed before there is a demand for storage. If farmers fail to expand wheat acreage and to use fertilizer, wheat storage on the farm will be sufficient. There is already one 500-ton godown located at the southern end of the valley near the road entrance. Valuable experience in godown management and fertilizer and grain storage will be forthcoming. The management of this godown is provided by the Kaski District Cooperative Marketing and Credit Union—a federation of 27 cooperative societies with a well-trained manager. Unfortunately it is poorly located to serve as a fertilizer depot because it is far from the primary crop producing areas of the valley.

The question of the advisability of constructing feeder roads is often brought up. When the Chinese-constructed Kathmandu–Pokhara road is finished, the valley will have a proper road from the southeastern corner of the valley to the Indian-built road and the bazar. The narrowness of the valley, combined with population pressures, makes the use of feeder roads uneconomical at this time. Exceptions to this would be the possibility of a road north of Pokhara and also a short road up the Bijayapur River Valley (see fig. 2). The network of footpaths and mule trails will probably be abandoned in favor of the Chinese- and Indian-built roads.

[29] Calculated from table 7 and table 25.

Various bridge and road projects have been successfully carried out under the "Back to the Village Campaign" and other programs. While the quantity of rhetoric may exceed the amount of work in some cases, substantial progress has been made in mobilizing village labor for construction of capital projects to increase the welfare of the whole community.

Irrigation

The two major irrigation projects in Pokhara are the Bijayapur (2880 hectares) and Phewa Tal (1200 hectares).[30] The actual area irrigated is much less than the capacity allowed by the design. There are two reasons. First, the design is faulty. The canals are cut deeply into the gravel and boulder subsoil in the valley and water losses are huge. Secondly, farmers use water for weed control in Pokhara, and the planned 4-foot depth per year is insufficient on porous soils. Thus the Bijayapur River irrigates about 300 hectares or 10 percent of the designed capacity. The canals from Phewa Tal irrigate 400 hectares or one-third of the designed capacity. Most of the khet land is irrigated by locally constructed dams and canals. The Kaun River irrigation scheme (approximately 50 years old) irrigates 500 hectares and is maintained by local contributions. Similarly, there are good irrigation canals in the north portion of the valley and the eastern end.

Further investment in irrigation will be necessary to bring more land into wheat production. As experience has shown, the best means of canal construction and design are known by the local inhabitants. Capital funds channelled through local government bodies would probably develop irrigation more effectively than large central government or Irrigation Department projects. A locally built and maintained canal would be an appropriate task for the "Back to the Village Campaign." A new canal from the Bijayapur is already being constructed with volunteer labor and funds from the Central Irrigation Department. Although this canal has been opposed by a few landholders, progress is substantial and an estimated 90,000 man-days of voluntary labor have been expended on it.

When the new varieties of rice are developed and distributed, the swampy soils lying to the south of Begnes Tal may have to be drained (see area r in fig. 4). Proper water control is difficult in this area, and a drainage project might have a significant effect on the production of high-yielding varieties. Because traditional varieties of rice do not require controlled drainage, the extension service must undertake the difficult task of educating the residents and local government in the importance of water control for success with improved varieties.

Applied research facilities

Perhaps the most challenging problem of development in Pokhara is the difficulty of assuring a constant supply of improved technology that

[30] These are design capacities for the canals, not actual area irrigated.

is adapted to conditions in Pokhara. Nepal has a very limited number of trained agricultural scientists. Because of this limitation, applied research has been undertaken primarily in Kathmandu. The new agronomy research station at Kumal Tar is making significant progress in selecting and adapting new varieties of rice, wheat, and corn for Kathmandu conditions. Because of large differences in elevation, type of soil, and rainfall between Kathmandu and Pokhara, the varieties selected for Kathmandu may not perform well in Pokhara. A former agronomy station in Pokhara was closed because of lack of irrigation, poor soil, and shortage of skilled managers. It might be possible for the research team in Kathmandu to provide seed, fertilizer, and supervision so the extension staff can run standardized testing of new varieties in farmers' fields. However, to do this, the Kathmandu research station would have to provide close supervision and generous and prompt support to the Pokhara extension service staff, which has not been trained in the methods of experimentation. Perhaps a research officer could be assigned to Pokhara to supply the needed expertise. At present the many other duties of the district agricultural officer prevent him from performing the research function effectively. The development of the agricultural sector depends on the provision of tested, significantly higher yielding varieties of rice, wheat, and maize. The replanting of mandarin oranges, once a major cash crop in Pokhara, depends on controlling disease and finding disease-resistant varieties of orange trees. Investment to provide these varieties and to control disease and insects should have a large effect on the agricultural output of Pokhara Valley.

Chapter 7.

Projections of Regional Income

This chapter draws the components and determinants of regional income into a single framework. Previous information and analysis will be brought to bear on the estimation of regional income. First, the economic condition of Pokhara Valley in 1968-69 (2025) will be presented. Next the rate of change of the variables will be specified and their value after 5 years will be given. A comparison of these two points in time will be made and some policy conclusions drawn. A similar procedure will be carried out for a 10-year period. Justification for the values and rates of change of the variables will not be presented; references will direct the reader to previous chapters where these variables have been discussed. The analysis presented in this chapter provides our best estimate of the

regional income and the potential growth possibilities of Pokhara. It is the intention to present a planning model in which the assumptions may be easily changed as the true values of the variables become better quantified. The model could be updated easily as time passes, and accurate rates of change using 1968-69 as a base could be obtained.

Analytical Framework

Two approaches to determining the regional income of Pokhara were employed: first, through examination of expenditures, and secondly, through examination of the sources of income. In simple macro-economic terms the two approaches may be developed as follows:

Expenditure of regional income

(1) $RI_1 = C_r + I_d + I_m + G_d + G_m + (X - M)$

where RI_1 is regional income

and C_r = total consumption by residents

I_d = net investment, domestic

I_m = net investment, imported

G_d = government expenditure, domestic goods

G_m = government expenditure, imported goods

X = exports of goods and services

M = imports of goods and services

In the above equation, C_r includes the consumption of both imported and domestically produced goods by residents of the valley. The consumption of goods by Gurkha soldiers on leave, and the consumption of Gurkha pensioners temporarily residing in Pokhara is included as a component of exports.

Sources of regional income

(2) $RI_2 = Y_c + Y_o + Y_{na}$

where RI_2 is regional income

and Y_c = income derived from cereal grains

Y_o = income derived from other agricultural production

Y_{na} = income derived from nonagricultural sources

There are 3 sources of regional income. These are cereal grain production, other agricultural production, and nonagricultural enterprises or services. If all the variables could be accurately measured, both estimates of regional income (RI_1 and RI_2) would be the same.

Comparison of regional income estimates

The following values for regional income and other variables are presented in summary. The method of obtaining these values is presented in the second section of this chapter.

Using equations 1 and 2, the regional income of Pokhara is Rs. 24.83 million and Rs. 26.86 million, respectively. The value of the variables are as follows:

$$(1)\ RI_1 = C_r + I_d + I_m + G_d + G_m + (X - M)$$
$$24.83 = 26.13 + 0 + 0 + 0 + (19.3 - 20.6)$$
$$(2)\ RI_2 = Y_c + Y_o + Y_{in}$$
$$26.86 = 18.39 + 1.68 + 6.79$$

In the first equation the values of I_d, I_m, G_d and G_m are unknown and were arbitrarily given the value of zero. Therefore, the estimate RI_1 understates regional income by the amount of these variables. This is the primary factor in the Rs. 2 million difference between RI_1 and RI_2.

Regional Income in 1968

In this section the method of obtaining the two estimates of regional income presented above is given.

Estimated by the expenditure of regional income

In equation (1), regional income was defined as the sum of consumption, net investment, government expenditure, and the trade balance. The following analysis uses this identity to determine the regional income of the Pokhara Valley for 1968.

Consumption (C_r). Consumption by residents of the valley totalled Rs. 26.125 million. This total includes goods produced in Pokhara and imported goods. The consumption pattern of an "average" family was carefully estimated for each of the 5 sample areas described in Chapter 3 (see table 3). Total consumption of the valley was determined by multiplying the estimated number of households in each area by the consumption pattern for individual commodities dominant in that area and summing the results. There are 8 town panchayats that have wards within Pokhara Valley. The panchayat boundaries do not coincide with the valley boundaries and so only a portion of each panchayat is included in this analysis.

Parts of 3 panchayats are assumed to have a consumption pattern similar to sample Area 1 because of their similar natural resource base, soils, and population. Half of the population of the Nagar panchayat falls in the consumption pattern of sample Region 2 and half in the consumption pattern of sample Region 5. Parts of 4 panchayats have a consumption pattern similar to sample Region 3 and only a few wards of one panchayat exhibit consumption patterns similar to sample Region 4.

Table 29 shows the population of each panchayat that lies within the valley. The population within these panchayats but outside the valley has been excluded. Each panchayat is listed under the consumption pattern which its population is most likely to have. Thus members of the Hyanga, Batulachaur, and Lamachaur panchayats are assumed to have the same average consumption as sample Region 1, which lies in Lamachaur. The

Table 29. Estimated consumption pattern of the total valley population*
(Pokhara Valley, 1968)

Regional consumption pattern‡ and panchayat	Within-valley†	
	No. households	Population
Pattern 1		
Hyanga	422	2,204
Batulachaur	398	2,079
Lamachaur	423	2,214
Subtotal	1,243	6,497
Pattern 2		
50% of Nagar panchayat	1,610	8,413
Pattern 3		
Argaun	373	1,949
Kandhanidanda	108	563
Chinidanda	457	2,390
Sisuwa	396	2,071
Subtotal	1,334	6,973
Pattern 4		
Rupakot	186	973
Pattern 5		
50% of Nagar panchayat	1,610	8,413
Totals	5,983	31,269

* Based on data from 5 sample areas.
† Approximately 1600 households containing 8368 people lived in these panchayats but outside the valley.
‡ Patterns are those of sample areas presented in Chapter 3.

number of households was determined from the population estimates assuming that the average household contains 5.227 people. Out of a total of 5983 households within the valley, 1243 follow the consumption pattern of sample Region 1. The number of households falling in the consumption pattern of sample Region 2 is 1610. The number of households falling in the consumption patterns of sample Regions 3, 4, and 5 are 1334, 186, and 1610, respectively.

The next step in the analysis was to multiply the estimated number of households in each region by the average consumption of various items in that region (see table 3). The results were then summed to provide an estimate of consumption of each commodity for the entire valley as presented in table 30.

Table 30. Estimated total valley consumption—volume and value
(Pokhara Valley, 1968-69)

Item	Volume	1968-69 price	Value
	MT	**Rs./ton**	**1000 Rs.**
Rice	4,289.8	2,518	10,807.7
Millet	1,417.2	1,192	1,689.3
Maize	2,380.9	1,336	2,780.1
Wheat	396.1	1,936	766.8
Subtotal cereal grains			16,037.9
Pulse	399.3	1,983	791.8
Milk	806.6	1,905	1,536.6
Ghee	119.0	12,650	7,505.4
Oil	105.1	6,494	682.5
Salt	304.6	484	147.4
Spice	34.5	8,735	301.4
Sugar	199.9	3,818	763.2
	1000 liters	**Rs. per 1000 liters**	
Kerosene	121.2	2,093	253.7
Eggs			41.9
Meat			849.6
Vegetables			740.2
Tea			350.2
Cloth			1,154.7
Cigarettes			591.8
Tob. leaf			65.8
Medicine			311.1
Total			26,125.2

The volume of consumption is given in the first column and then valued at the average market price for 1968-69. The total value of all consumption of the valley inhabitants is estimated to be Rs. 26.125 million.

Investment (I_d, I_m). The second component of regional income is net investment. Net investment of domestic goods and services includes unintended inventories in the shops and net investment in land, housing, irrigation, and livestock. No valuation was made of these investment items because of inability to accurately estimate them. There is some net investment from outside sources (I_m). The most important investment in this category is the new hotel being built on the lake shore. The source of investment funds is a member of the royal family and no estimate has been made of the magnitude of this or other investments from outside the region.

Government expenditure (G_d, G_m). Government expenditure includes payments for both domestic and imported goods. Although we do not know the amount of government expenditures in Pokhara, they could presumably be estimated accurately by government planners.

Trade balance ($X - M$). The final component of regional income is the trade balance. Total exports of goods equalled Rs. 11.8 million. To this total must be added the expenditures of Gurkha soldiers who disembark at the Pokhara airport and return to their hill villages for leave. They usually spend several days in Pokhara purchasing goods to present to their families. In addition to the coming and going of soldiers on active duty, a large number of pensioners spend several weeks in Pokhara every year. The total expenditure within the valley of these nonresidents is estimated to be approximately Rs. 7.5 million (see p. 55). Total exports of goods and services equal Rs. 19.3 million. Total imports equal Rs. 20.6 million resulting in an import surplus of Rs. 1.3 million.

The total of consumption, net investment, government expenditure, and the trade balance equals regional income as defined in equation (1).

Thus regional income exclusive of net investment and government expenditures is Rs. 24.83 million.

$$RI_1 = C_r + I_d + I_m + G_d + G_m + (X - M)$$
$$24.83 = 26.13 + 0 + 0 + 0 + 0 + (-1.3)$$

Regional income estimated from its sources

In equation (2), regional income was defined as originating from 3 sources: cereal grains, other agricultural products, and nonagricultural enterprises. Estimates are based primarily on the production data presented in Chapter 4.

Income from cereal grain production (Y_c). Agricultural production may be consumed, exported, paid as taxes to the government, or saved. The production of cereal grains comprises the major portion of agricultural income. The expected production of cereal grains was presented in table 11. Some further adjustments are required. It is assumed that the seeding rate for all crops is 4 manas per ropani. In the metric system this is from .025 to .034 tons per hectare, depending on the grain. Furthermore it is assumed that 20 percent of Kalikhola Phewa, Shyamsundar, Argaun, Sisuwa, and Satmuhane is owned by people living outside Pokhara Valley. This is deducted because the income derived does not accrue to residents of the valley; outside ownership is significant for rice only. For all grains, a 5 percent loss from insects and rodents has been deducted, with an additional 10 percent loss in weight estimated because of drying, loss during transportation, and other shrinkage. Rice is assumed to be 62 percent of the weight of paddy. The calculations presented in table 31 are based on the above-mentioned assumptions. The production of cereal grains is valued at the same prices as those used in the valuation of con-

Table 31. Production available for consumption—1968
(Pokhara Valley)

	tons		tons
Late paddy:			
Seed	102.0	Gross production	8,486.4
Rat damage	424.3	Deductions	2,114.5
Shrinkage	848.6	Net production	6,371.9
Outside ownership	739.6	62% milled rice	3,950.6
Total	2,114.5		
Early paddy:			
Seed	18.9	Gross production	1,398.6
Rat damage	69.9	Deductions	361.2
Shrinkage	139.9	Net production	1,037.4
Outside ownership	132.5	62% milled rice	643.2
Total	361.2		
Gaiya (dry-land paddy):			
Seed	18.0	Gross production	721.0
Rat damage	36.1	Deductions	126.2
Shrinkage	72.1	Net production	594.8
Total	126.2	62% milled rice	368.8
Total milled rice production	.....	.....	4,962.6
Maize:			
Seed	85.9	Gross production	2,736.0
Rat damage	136.8	Deductions	496.3
Shrinkage	273.6	Net production	2,239.7*
Total	496.3		
Millet:			
Seed	67.5	Gross production	2,184.6
Rat damage	109.2	Deductions	395.2
Shrinkage	218.5	Net production	1,789.4
Total	395.2		
Wheat:			
Seed	21.4	Gross production	630.0
Rat damage	31.5	Deductions	115.9
Shrinkage	63.0	Net production	396.1
Total	115.9		

* If there had not been hail damage and if yields had averaged 18.8 quintals/ha, net maize production would have been 4,286.2 tons.

Table 32. Income derived from cereal grain for 1968
(Pokhara, 1968)

Item	Volume	Price	Value of income
	tons	Rs./ton	rupees
Rice	4,962.6	2,518	12,495,827
Maize*	2,239.7	1,336	2,992,239
Millet	1,789.4	1,192	2,132,965
Wheat	514.1	1,936	995,298
Subtotal cereal grains			18,616,329

* Had maize not been destroyed by hail, volume would have been 4,286.2 tons and value Rs. 5,726,363. The subtotal would have been Rs. 21,122,005.

sumption (see table 30). The total income derived from cereal production is Rs. 18.6 million. These data are presented in table 32.

Income from other agricultural production (Y_o). Because of the difficulty in obtaining the production of minor crops, the data presented in the chapter concerning the sources of income are used (see table 4). These household data from the sample villages are multiplied by the estimated number of households in the valley falling into each group. The results are presented in table 33. The method is analogous to the technique employed in estimating total consumption. The value of other agricultural income (Y_o) is Rs. 1.7 million.

Nonagricultural income (Y_{na}). The estimate of nonagricultural income is similarly based on the sample household data and presented in table 33. This includes net income from shops, pensions of Gurkhas who are residents in the valley, and wages paid to those employed by the government. Because of lack of data it does not include income derived from the small industrial sector which includes furniture manufacturing, a sawmill, bakeries, and hotels.

For Region 5, the bazar, no income data were available. An income of Rs. 2884 (average of the other 4 sample areas) is employed. It is assumed that 50 percent of the income earned by bazar residents is derived from nonagricultural sources. Only 27 percent of the valley population lives in or adjacent to the bazar, illlustrating the rural nature of the economy. For the other areas, from 30 to 35 percent of income is derived from nonagricultural sources. A figure of 50 percent for the bazar seems reasonable because of the increased urbanization of this region, as well as the large number of shops. Furthermore, 10 percent of their income is assumed to be derived from noncereal agricultural crops. This is an average of Regions 1 and 2. The bazar lies geographically between these areas and has similar soil. The total value of nonagricultural income (Y_{na}) is Rs. 6.8 million.

Table 33. Income derived from other agricultural production and nonagricultural sources
(Pokhara, 1968)

Region	Av. household inc.*	No. households†	Income received
Other agr. production:	rupees		rupees
1	630	1,243	783,090
2	131	1,610	210,910
3	159	1,334	212,106
4	75	186	13,950
5	288	1,610	463,680
Subtotal noncereal			1,683,736
Nonagr. income:			
1	1,076	1,243	1,337,468
2	783	1,610	1,260,630
3	1,238	1,334	1,651,492
4	1,179	186	219,294
5	1,442	1,610	2,321,620
Subtotal nonagr. income			6,790,504

* From table 4.
† From table 29.

The alternate estimate of regional income for 1968 is the total of these categories of income:

$$RI_2 = Y_c + Y_o + Y_{na}$$
$$27.1 = 18.6 + 1.7 + 6.8$$

Thus the second method of income calculation provides an estimate of Rs. 27.1 million which is Rs. 2.3 million higher than that reached by the expenditure equation.

A note on trade

Pokhara is a major "transshipment" area providing the needs of the surrounding hill country. At least 90 percent of all exports from Pokhara originate from outside the valley. Terai rice, kerosene, salt, cloth, sugar, and cigarettes are the main export items. Of the Rs. 20.6 million worth of imports, Rs. 10.6 million are reexported by porter and mule train. Therefore, at least 50 percent of the imports are brought into the valley for purposes of reexporting. In addition, the expenditure of nonresidents in the valley contains a large import component. Practically every returning soldier carries saris, lanterns, umbrellas, and cigarettes to his home village. Therefore, the Rs. 7.5 million expenditure of this group contains a large reexport component. The nonagricultural income in Region 5, the bazar, is derived primarily from the commissions and marketing margins for handling these goods.

Projections of Regional Income for 1973

As a starting point for future projections, the regional income estimate of Rs. 29.833 million (from equation 2) will be used. This base figure is Rs. 2.734 million higher than the estimate for 1968-69, because it includes an estimated value of the maize lost by hail damage.

Using the projections of increased production of cereal grains given in table 26, and deducting insect, rat damage, and shrinkage as earlier, the estimated income derived from cereal grains (Y_c) is Rs. 26.699 million. The breakdown by grain variety is presented in table 34.

Three projections are presented to illustrate possible outcomes. Projection A assumes that income from cereal grains increases at the rate projected in table 26. It is further assumed that income from other agricultural sources increases at 1 percent per year. This low figure is predicated on the belief that as population increases at 2 percent, the intensity of farming will increase and some small quantities of relatively low-quality land will be brought into production, but that their marginal product will be well below the average product.

Projection B assumes that agricultural income increases at the same rate as Projection A; however, nonfarm income is assumed to increase at 5 percent per annum. This latter assumption would require an active investment program in tourism and small industry as well as increased trade activity. Under Projection A, regional income would equal Rs. 35.606 million, an increase of 5.773 million rupees. Increased cereal production accounts for 95 percent of this growth. Under Projection B, regional income increases by Rs. 7.301 million to Rs. 44.634 million. In this case, 73 percent of the increase in income is attributable to greater cereal production.

Projection C represents a static situation. It is assumed that all three components of Pokhara residents' income increased by only 1 percent per year—lowered by population pressure. Population is expected to increase at 2 percent per year. Given these assumptions, regional income would

Table 34. Income derived from projections of cereal production for 1973 (in 1968 Rs.)

Item	1973 production	1968 price	1973 value
	tons	Rs/ton	rupees
Rice	6,131.2	2518	15,438,362
Maize	4,620.9	1336	6,173,522
Millet	1,789.4	1192	2,132,965
Wheat	1,526.1	1936	2,954,530
Subtotal cereal grains (Y_c)			26,699,379

Table 35. Alternate projections of total income for 1973

Sources of income	Alternate projections*		
	A	B	C
		million rupees	
Cereal grain (Y_c)	26.699	26.699	22.199
Other agriculture (Y_o)	1.770	1.770	1.770
Nonagricultural (Y_{na})	7.137	8.665	7.137
Total income	35.606	37.134	31.106

* Alternative A: Income from cereals increases at rate given in table 34. Other agricultural income and nonagricultural income increase at 1% per year.
Alternative B: Same as A except nonagricultural income increases at 5% per year.
Alternative C: All components of residents' income increase at 1% per year.

equal Rs. 38.606 million in 1973. Results of the three projections are presented in table 35.

If the highway had not been constructed, Projection C would be the most likely alternative. But now there is the possibility of achieving Projection A with a well-executed agricultural program of the type mentioned in Chapters 5 and 6. To reach the Projections of Alternative B, the nonagricultural sector must be rejuvenated with carefully planned investment and certain barriers to trade must be eliminated.

Real per capita income of residents would increase at a rate of 1.8 percent per year under Alternative A, at 2.7 percent under Alternative B, and at −1 percent under Alternative C. There appeared to be a slight excess of production over consumption in 1968. If this is considered marketable surplus for the region as a whole, it can be compared with the marketable surplus for 1973 and 1978. For example, if consumption of cereal grains

Table 36. Estimated tonnage of cereals available for export in 1973*
(Pokhara Valley)

Cereal	Estimated production	Demand increase: Attributable to: Population	Demand increase: Attributable to: Income†	Available for export: 1968	Available for export: 1973
		tons			
Rice	6,131	4,736	141	673	1,254
Millet	1,789	1,565	35	372	190
Wheat	1,526	437	17	0	1,072

* Maize is omitted because of lack of a reliable consumption estimate.
† Assumes income increases according to Alternative A.

increases at 2 percent per year (the rate of population growth) plus a small increment due to increased incomes (based on the marginal propensity to consume presented in Chapter 2), then the marketable surplus for rice under Alternative B would be 1254 tons. Maize has been omitted because a reliable base figure for consumption is lacking. For millet and wheat, the surpluses are 190 and 1072 tons respectively (see table 36). The average annual production increase for cereals was presented in table 26. Rice and wheat production are expected to increase faster than demand within the valley. Maize and millet production are expected to increase at less than the rate of population growth.

Projections of Regional Income for 1978

The previous data may be projected for a 10-year period. So many unpredictable events will occur during this period that the estimates of regional income must be interpreted with great caution. Estimated income derived from cereal grains in 1978 is Rs. 33.211 million—price relationships may have significantly changed by 1978. The income from cereals is presented in table 37. It should be noted that wheat is projected to be a major component of cereal grain income.

Three alternative projections of total income are presented in table 38. The assumptions for each alternative are the same as in the previous section. With cereal production increasing at the projected rate, 1978 income would be Rs. 42.567 million. If both cereal and nonagricultural income increase, total income would be Rs. 46.132 million. If all components of income increase by 1 percent, income will be Rs. 32.675 million. These estimates are analogous to the 1973 projections under Alternatives A, B, and C, respectively. The 1978 projection based on Alternative C, like that for 1973, would result in a gradual decline of per capita income. It is assumed that the population of the valley will rise from 31,269 people in 1968 to 34,521 in 1973, and 38,117 in 1978. This is an annual increase of 2 percent. The effect of the various assumptions on per capita

Table 37. Projection of income derived from cereal production in 1978 (in 1968 Rs.)

Cereal	1978 production	1968 price	1978 value
	tons	Rs./ton	rupees
Rice	7,378	2,518	18,557,660
Maize	5,124	1,336	6,845,664
Millet	1,789	1,192	2,132,965
Wheat	2,931	1,936	5,674,416
Subtotal cereal grains (Y_c)			33,210,705

Table 38. Alternate projections of income for 1978

Sources of income	Alternate projections*		
	A	B	C
		million rupees	
Cereal grain (Y_c)	33.211	33.211	23.319
Other agricultural (Y_a)	1.859	1.859	1.859
Nonagricultural (Y_{na})	7.497	11.062	7.497
Total income	42.567	46.132	32.675

* Alternative A: Income from cereals increases at rate given in table 34. Other agricultural and nonagricultural income increase at 1% per year.
Alternative B: Same as A except that nonagricultural income increases at 5% per year.
Alternative C: All components of resident's income increase at 1% per year.

income of residents is presented in table 39. The actual level in 1968 was Rs. 860. This figure was adjusted to Rs. 945 to allow for the poor 1968 maize crop. The 1978 per capita income is estimated at 1120, 1210, or 860 rupees depending on the progress in the various income-producing sectors. The highway makes possible Alternatives A or B; without it, Alternative C would be most likely.

In 1978 approximately 4261 tons of grain would be available for export from the valley under alternative A (table 40). Slightly less would be available under alternative B because higher nonagricultural incomes would increase grain consumption modestly. According to the projections, wheat would be the most important export followed by rice. The composition by type of grain of the export surplus is misleading. Wheat consumption in 1968 was at a low level because little was grown in Pokhara. As production increases, consumption will increase in a direct relationship. One of the most important conclusions of Chapter 2 is that within the valley, consumption patterns closely follow production patterns.

Table 39. Per capita income levels of valley residents associated with projections

Year	Actual	Alternate projections*		
		A	B	C
			rupees	
1968	860	945	945	945
1973		1,030	1,075	900
1978		1,120	1,210	860

* Based on tables 35 and 38.

Table 40. Estimated tonnage of cereals available for export in 1978

Cereal*	Estimated production	Demand increase attributable to:		Available for export	
		Population	Income†	1968	1978
	tons	tons		tons	
Rice	7,370	5,230	311	673	1,829
Millet	1,789	1,727	78	372	– 16
Wheat	2,931	483	37	0	2,448

* Maize omitted because of lack of a reliable base figure for consumption.
† Assumes income increases according to Alternative A.

Production patterns are determined primarily by the natural resource base associated with each region. The resource base determines the relative profitability of the grains. Among grains there is great substitutability at the farm level. The increased wheat production will be primarily consumed on the farms where it is grown. In normal years maize may be exported, but relatively less wheat than is projected in table 40. The total quantity, however, should remain about 4261 tons regardless of the composition. The value of the exports may vary with the composition of trade, because of significantly different prices of the various grains.

The importance of undertaking steps to ensure distribution of new seeds and fertilizer cannot be overestimated, if Pokhara is to follow the path outlined in projections A or B. A much more vigorous program to field-test new varieties under Pokhara conditions will be necessary. The real challenge is in discovering the improved varieties, in demonstrating their effectiveness, and making the required inputs available. The importance of the highway in regard to providing inputs is tremendous, but without the new varieties and without demonstration, there will be no demand for these supplies. The potential of the highway, however, will be realized primarily through its effect on input prices and availability.

Chapter 8. Summary and Conclusions

Pokhara Valley was connected to the Indian border by a highway in April 1968. This previously remote valley in Nepal now is subject to new economic and social forces resulting from improved transportation. There is now the possibility that development, particularly agricultural development, can occur at an accelerated pace.

Objectives

This study was undertaken to provide an economic analysis of a traditional subsistence economy in transition to a more dynamic economy in which per capita incomes are increasing. The first objective was to develop a method to measure regional income, with particular emphasis on the agricultural sector. A framework within which change in regional income can be measured has been presented.

A second objective was to study the potential of the individual farmer to respond to changing economic forces resulting from price changes, new technology, and government programs.

A final objective was to provide information that could be used for formulating a development plan for the region. Projections of future regional income were presented. The quantity of cereal grains available for export from the valley was estimated.

Regional income in 1968

To meet the first objective, regional income for 1968 was estimated by two methods. The first estimate was based on a computation of total expenditures by valley residents on items of consumption. Consumption patterns were determined from a sample of 125 families purposely selected to represent the entire valley population. The second estimate of regional income was based on an analysis of various components of regional income. Income from cereal grains, other agricultural products and nonagricultural sources were calculated and then summed.

Following the technique of determining regional income by estimating total consumption expenditures, we obtained a value of Rs. 24.83 million. It is recognized that this method understates income in that it does not include capital investment or governmental expenditures. A regional income of Rs. 27.09 million was computed by summing estimates of the various components of regional income. The two estimates were derived using entirely different data. Their closeness provides a useful check on the procedures and indicates that they are near the true level of valley income. It is felt that the estimate based on sources of income is more nearly accurate, hence subsequent analysis was based on this figure.

Farmer Response

The second objective of the study was to determine individual farmer's potential for responding to the new economic relationships associated with the advent of the highway. Detailed consumption, expenditure, and livestock data were obtained from the 125-household sample for a 12-month period. These families were located in 5 different areas within the valley. The areas, representative of different soils, water resources, and types of settlement, were used to estimate the responses of the entire population of the valley to changing economic forces.

The household consumption data were analyzed in detail to determine if traditional consumption habits would hinder the acceptance of a changing cropping pattern and diet. In general there was much more variation among sample areas than within the sample households of one area. Variation in consumption of cereal grains depended primarily on the cropping pattern of the household and this in turn depended mainly on the location of the household within the valley. Thus new technology which alters costs and returns of cereal production will have a dramatic effect on the consumption pattern. Already families within the area most suited for growing Mexican-type wheat (Lerma 52) consume 2.5 to 5 times more wheat per capita than other areas. This type of wheat was introduced into the valley only 5 years before the present study and has almost completely replaced mustard, the traditional crop on that land. Variation in consumption due to the caste of the household was important only for a very few items. This indicates that tradition will not seriously hinder a shift of cropping pattern and consumption.

A total of 4080 hectares of paddy were planted, about 15 percent of which was of an early local variety. Wheat was planted as a second crop on 630 hectares of paddy land. It was estimated that this represented about 35 percent of the paddy land that could support a wheat crop with minor improvements in irrigation and major improvements in fencing.

On the upland soils 2736 hectares of maize, double-cropped with 1986 hectares of millet, provided the major crops. Dry land rice (gaiya), cane, buckwheat, and tobacco were minor crops. The total cultivated area of upland was 3556 hectares.

There were many varieties of paddy grown in Pokhara, depending on soil and water conditions. Yields determined by crop cutting and weighing averaged 18.5 quintals and 21.5 quintals per hectare for medium and fine rice varieties. In 1968 serious hail damage lowered yields, giving an average of 10.0 quintals per hectare. Average maize yields, estimated to be 18.8 quintals per hectare, were more typical. Millet averaged 11.0 quintals per hectare, and local wheat, 6.0 quintals per hectare. Improved wheat varieties yielded from 10 to 18 quintals per hectare depending on fertilization. Yields in Pokhara generally exceeded the average yields for India and Pakistan by a small margin. Total production of major crops was calculated by multiplying the estimated area by the average yields. In 1968, 9.7 million tons of paddy, 0.6 million tons of wheat, 2.7 million tons of maize, 2.2 million tons of millet, and 0.7 million tons of dryland paddy were produced.

The long-run effects of improved transportation will significantly influence the cropping pattern. New varieties of fertilizer-responsive rice will be introduced to the valley. Progress will first be made on the early paddy soils because they are better drained and because the quality of milled rice is comparable to the quality of the local, early rice. Also the harvesting date of varieties like Chainung 242 is only a few weeks after

the local early rice. However, with an active extension program, and most important, increased effort expended in finding new varieties of paddy, an annual production increase of 4.2 percent could be maintained for the next 10 years.

Some "synthetic" maize varieties have proved successful in other parts of Nepal. With fertilizer use and new varieties, maize production should increase 1.7 percent per year. Fertilizer-responsive wheat varieties have already been introduced into Pokhara. Lerma 52 is now the most frequently planted variety. There is considerable potential for increasing wheat acreage, and this, combined with increased fertilizer use, should enable total production to increase 18.8 percent annually.

If these production goals can be attained, fertilizer use will increase from a total of 3 tons of nutrients in 1968 to 182 tons in 1978. In 1978, 129 tons of nitrogen, 40 tons of phosphorus, and 13 tons of potassium will be needed to achieve the production increases postulated above. Other necessary inputs such as insecticides and fungicides will present difficult problems of education and distribution. The needed tonnage of such items will be small.

The highway will have some effect on the distribution of incomes within the valley. The wheat-growing areas will benefit the most, and the areas with a high proportion of upland crops such as maize and millet will benefit least. The incomes of merchants will also be augmented if trade increases in the bazar. The future of Gurkha pensions will affect the growth of Pokhara bazar as a trade center for western Nepal.

Regional Planning

The third objective of the thesis was to provide information to be used in planning the development of the valley. The nonagricultural commerce and trade of the valley was also analyzed.

Each area of the valley has its own cash crops. It was impossible to accurately measure marketings, but expenditures varied from 30 to 50 percent of total income. Many of the purchased items originated within the valley, but practically all manufactured goods were imported from India.

The pattern of trade in Pokhara was complex and the traders in the bazar handled many goods that were not intended for the valley inhabitants, but were for reexport to other parts of Nepal. Margins from this trading function provided income for many of the Newars and Thakalis living in the bazar. Major exports to the North and West were rice, cloth, cigarettes, sugar, salt, and kerosene. Salt, cigarettes, and cloth were exported to the East from Pokhara. Maize, wheat, ghee, spices, and skins were imported from the North into Pokhara, while rice, livestock, and pulse were the important imports from the East. From the South, there was a large flow of imports. Approximately seven 5-ton trucks per day travelled the new highway. Rice, kerosene, cloth, and cigarettes were the

main items. Sugar, salt, and mustard oil were also large import items. Some cement and fertilizers entered the valley by truck. A net trade deficit of Rs. 8.7 million was primarily balanced by Gurkha expenditures of Rs. 7.5 million. The prosperity of the trading community as well as the inhabitants of the hills around Pokhara depends to a large extent on the continuance of Gurkha expenditures. Long-range planning should consider alternate sources of income for these hill people. Within the valley, pensions were not a major source of income except indirectly through the trading community.

Income from cereals varied from 65 percent to 75 percent of total income. However, there was great variability in the composition of this total. Rice accounted for from 20 percent to 60 percent of total income. Likewise, although nonagricultural income was similar in magnitude between areas, the sources were quite different.

It might have been assumed that prices of consumer items would have been greatly affected by lowered cost of transportation following the completion of the highway. It was certainly true that the price of salt, cement, fertilizer, and potatoes declined greatly after the road opened. However, Nepalese rupee revaluation in June 1966 and devaluation in December 1967, combined with seasonal variations in prices and changing import taxes, prevented a clearcut change in commodity prices. The important price effect has been to connect the Pokhara market more closely to the Terai market of Bhairawa. Following completion of the road the price differential between the two markets was generally Rs. 25 to Rs. 45 per quintal. Before the road, these margins were much greater, about Rs. 70 to Rs. 300 per quintal.

The short- and medium-term influences of the highway are primarily the income effects caused by the reduction of prices. A Rs. 100 increment in family income would be partially saved, partially invested, and partially expended on increased consumption. At least Rs. 55 would be spent on the consumption items studied—with Rs. 35 spent on rice, pulse, and cloth.

Various unrelated but very important factors will determine the development of Pokhara Valley. Population growth requires a continual increase in production just to maintain per capita incomes at a constant level. Pokhara may well experience an increased inflow of tourists. If local entrepreneurs can take advantage of this opportunity, considerable income can be generated from this industry. Increased air service, improved quality of meats and vegetables, and organized expeditions and entertainment may be necessary to make Pokhara a successful tourist area. Other small industries such as slate quarrying, furniture manufacturing, and manufacturing plants using agricultural products as their raw material are already present in Pokhara. Income from this miniature industrial sector could be expanded greatly with careful investments and suitable investment policies.

Government organizations and policies will be important in accelerating or slowing the rate of growth. The panchayat system has an uneven record, but in some areas of the valley it has proven a successful medium for stimulating development. The extension service has a particularly difficult task to perform because it must test new varieties in Pokhara as well as disseminate new seeds and introduce new techniques. Land reform has not been important in Pokhara. Most of the land is in very small holdings. Compulsory savings are meant to increase the rate of savings of the agricultural sector, and to provide a source of capital for investment in agriculture. Difficulties of collection and storage have limited the value of this program in its initial years. Cooperative societies backed by the Agricultural Development Bank have not been very successful to this point, and perhaps their functions could be taken over by the compulsory savings committees and the Land Reform Office. However, these institutions are undergoing rapid changes and our comments may be woefully out of date.

At present, storage facilities are adequate for fertilizer and grain. If development proceeds rapidly a second godown located in the wheat growing area would be needed. Because of the high costs of building construction in Pokhara, this godown should not be built far in advance of the need. When the Chinese-built Kathmandu–Pokhara road is completed, there will be a proper road running the length of the valley. It is possible that short feeder roads leading up the Bijayapur River valley and up the Seti River valley would be good investments. Considerable paddy land would be lost by over-investment in roads. Rice and wheat can easily be carried across dry paddy lands with the bunds removed.

Investment in irrigation should be directed towards increasing the area of irrigated wheat, and towards providing proper water control and drainage for the fertilizer-responsive varieties of rice. Investment of talent and resources to provide a constant stream of new crop varieties and improved agricultural practices will be the most important factor in sustaining a rapid increase of income in Pokhara Valley.

Projections of Regional Income

Taking all these factors into account, projections of regional income for 5- and 10-year periods were made. It was assumed that income from paddy, maize, and wheat would increase at an average annual rate of 4.2 percent, 1.7 percent, and 18.8 percent respectively. Income from agricultural production other than cereals was assumed to increase at the rate of 1 percent annually. Similarly, income from nonagricultural sources was assumed to increase at 1 percent per year. Given these assumptions, regional income would increase from Rs. 29.8 million in 1968 to Rs. 35.6 million in 1973, and Rs. 42.6 million in 1978. If the valley population increases at 2 percent per year, per capita incomes would increase from

Rs. 945 in 1968, to Rs. 1030 in 1973, and to Rs. 1120 in 1978. Serious hail damage to maize in 1968 lowered actual regional income to Rs. 26.9 million and per capita income to Rs. 860. Adjusted higher figures were used as a base for projections, but year-to-year variation in crop yields would mean that projections for any particular year might be subject to considerable error.

Without the highway, growth in regional income would be much less. Assuming an overall growth of income of 1 percent in response to population increase, regional income would rise from Rs. 29.6 million in 1968 to Rs. 31.1 million in 1973 and to Rs. 32.7 million in 1978. Given this stagnant replicative type of growth, per capita incomes would fall from Rs. 945 to Rs. 860 in the 10-year period. The importance of assuring the availability of fertilizer and new varieties of crops, of extending dry-season irrigation, or improving drainage in the late-paddy areas, and of encouraging investment in the nonagricultural sector should be clear.

In conclusion, Pokhara Valley is now in the enviable position of having the opportunity to progress rapidly enough so that production and regional income increase faster than population growth. The new highway linking Pokhara with the Terai is the enabling mechanism, but many difficult tasks still lie ahead before the inhabitants of the valley can fully realize the possible economic benefits.

Appendix table 1. Livestock holdings of 25 households
(1968, Pokhara–Region 1)

Animals & age (yrs.)	Number owned on: Sept. 15	Number owned on: Mar. 15	Purchased		Sold		Born	Died	Slaughtered
			no.	Rs.	no.	Rs.	number		
Cows (16 households) . .			0	0	2	225	4	4	0
>1	3	6							
1-3	9	11							
3+	32	34							
Bullocks (16 households) . .			2	690	2	230	5	2	0
>1	6	2							
1-3	6	5							
3+	25	29							
Buffaloes (22 households) . .			6	2,480	4	940	20	7	0
>1	10	12							
1-3	16	14							
3+	39	35							
Goats & sheep (14 households) . .	65	82	20	1,800	4	257	29	8	1
Chickens (16 households) . .	98	179	8	48	4	38	50	n.a.	n.a.

Appendix table 2. Feed requirements for livestock per household
(1968, Pokhara–Region 1)

Item	Conversion factor	Feb.-July	Aug.-Mar.	Total
		kg	kg	kg
Maize flour	50.6 kg/muri	105	102	207
Millet	67.3 kg/muri	51	17	68
Paddy husk	15.0 kg/muri	23	15	38
Maize stalks	25.0 kg/load	1,706	40	1,746
Rice straw	25.0 kg/load	1,364	373	1,737
Green grass	15.0 kg/load	5,052	3,603	8,655
Salt	4.67 kg/pathi	6	6	12

Oil, ghee, eggs, rice, pulse, and soybeans fed intermittently for festivals.

Appendix table 3. Livestock holdings of 25 households
(1968, Pokhara–Region 2)

Animals & age (yrs.)	Number owned on: Sept. 15	Number owned on: Mar. 15	Purchased		Sold		Born	Died	Slaughtered
			no.	Rs.	no.	Rs.	number		
Cows (17 households) . .			3	210	1	200	4	2*	0
>1	4	3							
1-3	4	5							
3+	29	25							
Bullocks (12 households) . .			6	1,350	2	260	2	3	0
>1	5	3							
1-3	4	0							
3+	18	18							
Buffaloes (20 households) . .			5	1,830	6	1,690	9	3	0
>1	7	4							
1-3	9	11							
3+	23	19							
Goats & sheep (12 households) . .	28	36	1	60	3	205	13	0	5
Chickens (7 households) . .	36	45	0	0	13	57	n.a.	0	7

* Includes cows given to charity.

Appendix table 4. Feed requirements for livestock per household
(1968, Pokhara–Region 2)

Item	Conversion factor	Feb.-July	Aug.-Mar.	Total
		kg	kg	kg
Maize flour	56.0 kg/muri	71	89	160
Millet	67.3 kg/muri	29	37	66
Paddy husk and bran	15.0 kg/muri	19	23	42
Maize stalks	25.0 kg/load	2,645	670	3,315
Rice straw	25.0 kg/load	561	538	1,099
Green grass	15.0 kg/load	2,467	3,117	5,584
Salt	4.67 kg/pathi	6	13	19

Oil, ghee, eggs, rice, pulse, soybeans fed for festivals.

Appendix table 5. Livestock holdings of 25 households
(1968, Pokhara–Region 3)

Animals & age (yrs.)	Number owned on: Sept. 15	Number owned on: Mar. 15	Purchased		Sold		Born	Died	Slaughtered
			no.	Rs.	no.	Rs.	number		
Cows (14 households) . .			3	390	0	0	8	10*	0
>1	10	7							
1-3	5	3							
3+	27	25							
Bullocks (21 households) . .			6	1,862	5	1,090	8	5	0
>1	5	5							
1-3	2	1							
3+	29	27							
Buffaloes (18 households) . .			10	3,850	5	2,300	14	9	0
>1	14	14							
1-3	3	2							
3+	39	39							
Goats & sheep (10 households) . .	26	36	8	618	2	80	17	8	12
Chickens (11 households) . .	62	80	2	20	4	30	41	0	21

* Includes 2 cows given to charity.

Appendix table 6. Feed requirements for livestock per household
(1968, Pokhara–Region 3)

Item	Conversion factor	Feb.-July	Aug.-Mar.	Total
		kg	kg	kg
Maize flour	56.0 kg/muri	89	93	182
Millet	67.3 kg/muri	38	11	49
Paddy husk and bran	15.0 kg/muri	17	24	41
Maize stalks	25.0 kg/load	2,596	600	3,196
Rice straw	25.0 kg/load	2,652	2,475	5,127
Green grass	15.0 kg/load	2,179	1,816	3,995
Salt	4.67 kg/pathi	17	15	32

Oil, ghee, eggs, rice, pulse, soybeans fed for festivals.

Appendix table 7. Livestock holdings of 25 households
(1968, Pokhara–Region 4)

Animals & age (yrs.)	Number owned on: Sept. 15	Number owned on: Mar. 15	Purchased		Sold		Born	Died	Slaughtered
			no.	Rs.	no.	Rs.	number		
Cows (9 households) . .			4	88*	1	85	6	2	0
>1	8	8							
1-3	4	6							
3+	21	20							
Bullocks (14 households) . .			7	1,545	1	200	6	7	0
>1	0	1							
1-3	2	2							
3+	24	26							
Buffaloes (21 households) . .			33	13,370	24	8,096	20	17	1
>1	16	15							
1-3	7	10							
3+	33	29							
Goats & sheep (8 households) . .	34	51	11	650	6	310	39	3	8
Chickens (19 households) . .	150	142	19	133	12	57	300	50	210

* Two cows on lease.

Appendix table 8. Feed requirements for livestock per household
(1968, Pokhara–Region 4)

Item	Conversion factor	Feb.-July	Aug.-Mar.	Total
		kg	kg	kg
Maize flour	56.0 kg/muri	49	47	96
Millet	67.3 kg/muri	34	0	34
Paddy husk	15.0 kg/muri	7	14	21
Maize stalks	25.0 kg/load	1,710	0	1,710
Rice straw	25.0 kg/load	757	300	1,057
Green grass	15.0 kg/load	1,020	1,469	2,489
Salt	4.67 kg/pathi	11	5	16

Oil, ghee, eggs, rice, pulse, soybeans fed for festivals.

Appendix table 9. Livestock holdings of 25 households
(1968, Pokhara–Region 5)

Animals & age (yrs.)	Number owned on:		Purchased		Sold		Born	Died	Slaughtered
	Sept. 15	Mar. 15							
			no.	Rs.	no.	Rs.	number		
Cows (11 households) . .			1	275	1	160	1	3	0
>1	3	4							
1-3	5	9							
3+	17	13							
Bullocks (5 households) . .			0	0	0	0	1	2	0
>1	1	1							
1-3	0	1							
3+	8	5							
Buffaloes (11 households) . .			1	700	0	0	2	3	0
>1	8	5							
1-3	1	5							
3+	17	12							
Goats & sheep (6 households) . .	11	12	1	60	0	0	5	0	2
Chickens (17 households) . .	122	180	n.a.		n.a.		n.a.	n.a.	n.a.

Appendix table 10. Feed requirements for livestock per household
(1968, Pokhara–Region 5)

Item	Conversion factor	Feb.-July	Aug.-Mar.	Total
		kg	kg	kg
Maize flour	56.0 kg/muri	105	51	156
Millet	67.3 kg/muri	10	9	19
Paddy husk	15.0 kg/muri	31	28	59
Maize stalks	25.0 kg/load	1,350	259	1,609
Rice straw	25.0 kg/load	945	392	1,337
Green grass	15.0 kg/load	3,189	839	4,028
Salt	4.67 kg/pathi	4	5	9

Oil, ghee, eggs, rice, pulse, soybeans fed for festivals.

Appendix table 11. Reported sales by region

Item	1	2	3	4	(Bazar) 5
			rupees		
Rice	40	67	1,013	106	
Paddy	84	159	8,345	920	
Millet	201	162	114		44
Maize	295	317	184	18	7
Wheat		48	721		
Eggs	207		31		
Milk	186	563	587	1,760	138
Meat	223	147	392	236	261
Fish				99	
Ghee			22	24	
Mustard			30		
Pulse			375		
Vegetables	105	62	861	6	
Fruit	322	21	142	3	
Sugar	589	16			
Timber bamboo	236	200	25		
Firewood		323			
Peanuts	328				
Miscellaneous	42				
Totals	2,858	2,085	12,842	3,172	450

Appendix table 12. Prices used for conversion of trade volume to value of trade
(Porter traffic)

Item	Price per ton
	rupees
Paddy	1,600
Rice	2,332
Maize	1,116
Maize flour	1,276
Wheat	1,784
Millet	1,189
Kerosene (1,000 liters)	2,222
Salt	478
Cloth (bale)	1,500
Mustard oil	6,000
Ghee	12,000
Sugar	3,430
Vegetables (potato)	1,072
(onion)	1,286
Pulse	1,948
Biscuits (tin)	35
Milk	1,905
Fruit	
Cigarettes (box)	275
Bamboo goods	
Livestock (buffalo)	500
(goat)	75
Wood (load)	3
Meat (buffalo)	3,430
(goat)	5,145

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