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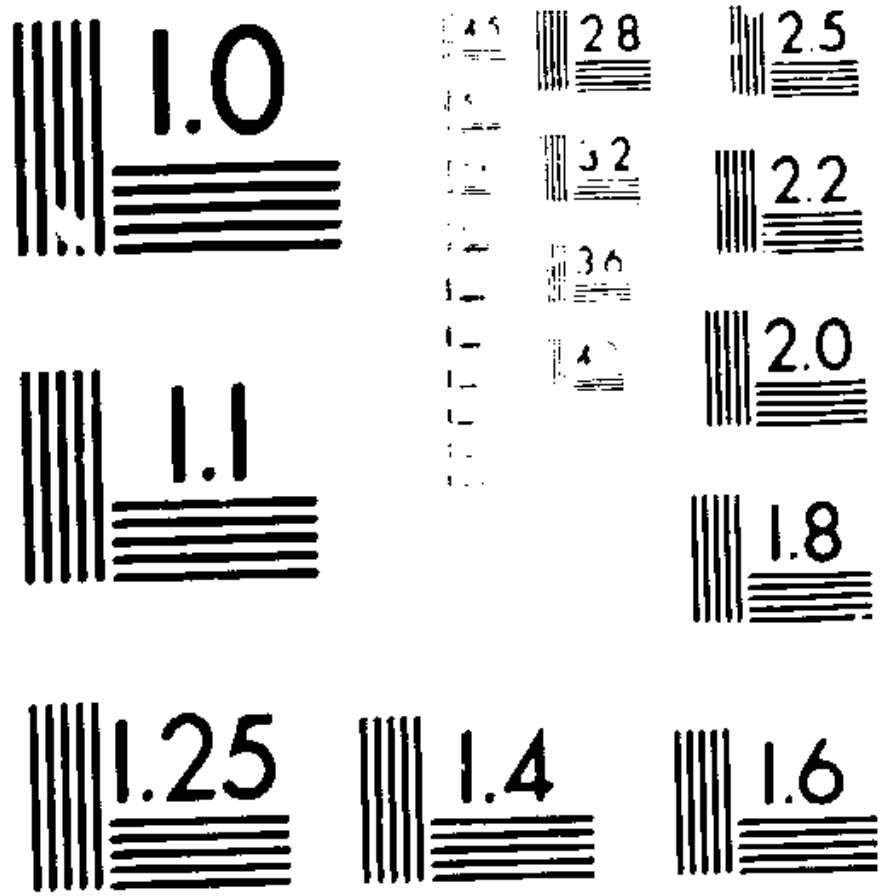

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TOWARDS VIABLE BALANCED GROWTH STRATEGIES:

A LOCATIONAL PERSPECTIVE*

Prepared by the

Global and Conceptual Studies Branch
Division for Industrial Studies**

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I INTRODUCTION

The post-World War II era has witnessed sustained efforts at transition and growth in the Third World. In the 1950s development theory emphasized growth, focussing on import substitution. In the 1960s and 1970s both theoretical analysis and policy focussed heavily on the impact of international trade in the context of the industrialization effort. This inevitably led to an emphasis on the promotion of a centralized urban development pattern and on the relations between this enclave and the rest of the world. Development strategies and policy packages were put in place designed for that enclave with, often unintended, neglect of their impact on the preponderant rest of the system, i.e. agriculture and decentralized industry and services. The rather unbalanced growth pattern that resulted has been generally characterized by insufficient participation of the system's entrepreneurial and other human resources as well as generally unsatisfactory productivity performance in both the industrial and agricultural sectors.

In more recent years, policy-makers and analysts in many countries have become increasingly aware that this tendency for modernization to be concentrated in enclaves with only a small proportion of the total population fully engaged may have unacceptable effects for output but especially for employment and income distribution.

If one looks at the post-war performance of the third world as a whole, for instance, in 42 developing countries industrial growth was, on average, 7.0% p.a. from 1960 to 1981, while agricultural output grew by less than half (2.9% p.a.). Relatively stagnant agriculture has held back growth in non-agricultural activities in a number of countries, since a dynamic agriculture can provide the foundation for development of the whole economy. Similarly, an industrial sector which is not growing fast enough will hold back

agricultural modernization as well as the growth with equity of the system as a whole. This issue is fundamental for countries still at an early stage of development, e.g. in Africa, but is highly relevant almost everywhere, including in the middle income countries of Asia and Latin America. Moreover, the deterioration of the international environment since 1973 has threatened the continued viability of the traditional growth path in many parts of the developing world, as evidenced by the increasing magnitude of the so-called debt problem, and has caused pressure for a re-examination.

Fresh thinking about development strategies is thus clearly indicated and it is going on. In the Southern Cone of Latin America, for instance, policy makers, having been burned by what they perceive as the lack of dependability of the international economy, in combination with a flawed textbook Chicago School policy approach, are threatening to move back to an import substitution stance. Others believe the end of the recession will rescue them without further need of adjustment. Others, including ourselves, believe that a development strategy which encompasses domestic balanced growth but without abandoning an increasingly open economy stance may be the optimal way to proceed - as has been demonstrated in a number of successful development cases. It is towards the fleshing out of such new development strategies, modified for different types of developing countries, that this research will be directed.

It is our aim, therefore, to achieve a better understanding of the critical linkages between industrial and agricultural activities in different types of developing economies at different stages of their transition, the factors which affect the strengths and weaknesses of these linkages, and the identification of government policies to strengthen them where they are weak.

In the early import substitution stage of development, the agricultural sector provides essential resources (including food to feed industrial workers)

to finance industrial development, as well as constituting an important market for industrial products. At a later stage, many countries have adopted strategies of industrialization involving secondary import substitution, relying heavily on imported capital, which tends to further separate their industrial development from their agricultural development. These strategies have encountered increasingly serious problems, both internal and external. Internally, the growth has been more and more compartmentalized, concentrated on the modern enclave and limited in human capital participation. Externally, foreign exchange and debt problems have emerged in recent years. Both are related to the increased disarticulation between agricultural and industrial sectors, or the weakness of internal linkages.

Industrialization forms an intrinsic part of the transition to modern growth. The industrial sector constitutes an ever larger and the agricultural sector an ever smaller proportion of total output, employment and exports, as development proceeds. The achievement of sustained balanced growth in both sectors is of critical importance to the aggregate development performance of all countries. For example, few, even in the middle income group, can afford to rely heavily on the importation of food. Moreover, the performance of the agricultural sector is a major cause of regional variation in economic achievement with weak agricultural performance dragging down the system as a whole. Among the agrarian poor, productivity in agriculture is critical not only because of the direct effects on output and incomes, but also because of the effects of agricultural prosperity in generating opportunities outside agriculture, in associated industries, such as the production and sale of consumer goods, farm machinery repair and manufacture, and so on. Industrial development which is based on increased agricultural output is more likely to be sustainable and involve a wider participation in terms of employment and

regional balance.

Most efforts to understand successful modernization in both agriculture and industry have tended to focus on each of these sectors independently, without looking at the linkages between them. For example, in agriculture, performance has conventionally been viewed as the consequence of physical inputs, plus technology, into the sector; alternatively, the 'organizational' school has focussed on the way in which agricultural production is institutionally organized, as the key element. The significance of linkages, as a factor explaining agricultural performance, has rarely been included. Similarly, industrial performance has been assessed mainly in terms of physical inputs, especially the rate of capital accumulation, technology change, and the trade orientation, e.g. whether it involves import substitution, export promotion, and the type of import substitution or export orientation involved. The importance of links with the agricultural sector in determining the overall sustained growth rate, and the nature of that growth in terms of employment and technology choice and location has usually been neglected.

Our approach, by contrast, focusses on the 'linkages' factor in determining growth in the aggregate, and in each sector. We believe that this adds an important dimension to understanding the transition growth process. This does not mean that previous approaches become irrelevant. In agriculture, physical inputs, technology, and organization remain of significance, as do accumulation, technology, and trade orientation in industry. But the linkage factor adds importantly to the previous approaches mainly because it represents a crucial, neglected dimension in the achievement of balanced growth involving the hinterland, along with the outer-oriented enclave. Such balanced growth is defined as occurring where both sectors - agriculture and non-agriculture - develop in a balanced way each providing inputs and incentives for the other,

with mutually sustaining expansion in supplies and markets. Balanced growth emphatically does not imply autarchic growth but is consistent with and, in fact, requires an increasingly open economy setting for efficiency reasons. The aim of our approach is to explore the conditions for balanced growth in this context.

In Section II we present a selective survey of the relevant literature. Section III sets out an overall framework, describing the main linkages between agriculture and non-agriculture and classifying the various economic functions linkages perform - namely transactions concerning commodities, labor, and finance. These linkage functions must be "well performed" for successful development to take place. The way in which each is performed will be affected by the existing structure of each sector as well as by infrastructure and policies. The nature of the linkages in turn affects subsequent developments in each sector, both with respect to the overall rate of growth and with respect to distributional effects. Such a functional approach, drawing on all three schools of analysis described above, is essential. It includes the major elements covered in the 'linkages' literature, as indicated by our review of that literature in Section II. But it also extends the analysis by providing a comprehensive framework and examining the relationships between the initial structure and distribution, static linkages, and dynamic aspects.

Section IV advances the analysis by making the spatial dimension an integral part of the analytical landscape. This spatial dimension is especially important when the country is large and the population is widely spread out. Modern activities, agricultural and non-agricultural, tend to be located where transport links with the outside world are good, often on a coastal plain, constituting an enclave; this forms a barrier, caused by distance and poor transport, to the spread of activities based on modern

science and technology. Hence linkages may be limited. The situation provides an important spatial and locational dimension to our analysis of dualistic interactions.

II Review of Recent Literature

The proposed linkages project is designed to examine factors affecting the process of dynamic interaction between agriculture and non-agriculture. Some of these linkages take place at the level of the whole economy and are rather indirect, while others are more direct and can be observed at the micro-level. For example, a commonly observed macro-linkage occurs when the agricultural sector produces exported crops, providing the foreign exchange which finances the early stages of industrialization. Connected with this, the agricultural sector has historically often been the major source of savings in the early process of development. These macro-relationships are highly important - in some cases agricultural stagnation is responsible for industrial stagnation because of failure at this level. More direct linkages concern the way in which the sectors interact in terms of the demand and supply of commodities.

There has been considerable work, both of a theoretical and empirical nature, on these macro-relationships. (A survey of some of this appears in John Mellor's "Accelerated Growth in Agricultural Production and the Intersectoral Transfer of Resources," Economic Development and Cultural Change, 22, 1973-4). However, in the literature survey below we cover only the work that has been concerned with direct or micro linkages, since this is the prime focus of our study. Moreover, we have selected only those studies which provide empirical evidence on the relationships and their underlying causes. We cover, therefore, only a subset of the literature on linkages. A critical issue is why a given increase in some rural activity (normally agricultural) should give rise to more substantial expansion in other domestic activities in some situations than others. Another is why agricultural productivity rises faster

in some situations than others in the first place. The literature covered below was selected where it helped to provide some empirical evidence on these issues. Our aim has been to consider the methodology used in each of the studies, in order to help us design our own approach to the problem.

Direct linkages may take the form of consumption linkages: i.e. where incomes generated by activities in one sector lead to demand for output of another sector. These, clearly, may operate both from agriculture to non-agriculture and conversely. Secondly, there are production linkages, which may be backward or forward. Backward production linkages occur where productive activity in one sector requires inputs from another, e.g. of machinery or fertilizer. Forward linkages occur where production of a commodity provides supplies for productive activities in other sectors. Formally, a forward linkage of one sector may be regarded as a backward linkage of another - i.e. the use of cotton grown domestically in spinning represents a forward linkage from the point of view of agriculture, and a backward linkage from the point of view of the textile industry. What is emphasized is in part a matter of which industry is the main focus of study, and in part of which sector is thought to be the initiating or causal agent of the linkage.

The literature has variously considered each of these linkages in particular contexts, but we have found no case where a comprehensive approach has been adopted, identifying all the direct linkages. There are four stages to a full study of linkages, sufficient to lead to policy conclusions: first, identification of linkages; second, identification of the causes of or obstacles to the full working of observed linkages; third, an evaluation of the importance of various linkage flows; and fourth, the identification of relevant policies. The literature has been primarily concerned with the first - identification - but has also touched the second. The third issue - evaluation

- has been largely overlooked, and some have come to policy conclusions skipping this stage. While there is a general presumption that linkages are desirable, this is not always the case; hence the need for evaluation. For example, in the Indian context, a policy which offered subsidized credit to large farmers would lead to high linkages with domestic tractor production. But many evaluations have shown that large-scale tractor use often has negative economic and social returns. Moreover, Indian tractor production is very high cost, as it is highly protected, so that resources might better be employed in other activities. In such a case, evaluation might suggest reducing rather than promoting that particular type of linkage. Linkages are not an end in themselves.

From historical case studies, especially those connected with the "staple" theory of growth, it has long been recognized that the linkages generated by agricultural activity are crucial to whether that activity will lead to sustained economic growth of the country as a whole or whether the activity will remain an enclave within a generally stagnant economy. Perhaps the broadest generalization that can be made in this regard is that put forward in Douglas North's paper "Agriculture in Regional Economic Growth" in Eicher, C. and L. Witt, eds., Agriculture in Economic Development (New York, McGraw-Hill , 1964). His basic message is that family farms stimulate domestic industry while plantations do not. This difference is attributed mainly to the differences in income distribution of these two regimes; while rich plantation owners demand imported luxury goods, and poor plantation workers demand little that they could not provide for themselves, middle class family farmers demand goods that could be produced by domestic industry. This argument deals only with consumption linkages from increases in

agricultural production. Production linkages, on the other hand, were emphasized by R.E. Baldwin in his paper "Export Technology and Development from a Subsistence Level," Economic Journal, March 1963. He argued that when the export industry requires large amounts of complex capital equipment, as did mineral extraction, domestic production linkages are very small because domestic factor endowments do not permit efficient production. On the other hand, if the export industry requires a lot of construction outlays, for example, the chances for the creation of local industries are more favorable. Not only are transportation costs on such items as brick, cement, and timber high in relation to production costs, but these commodities do not require as much skilled labor as the equipment industry. Baldwin also emphasizes the forward linkages of the output of the export industry.

The following five papers surveyed all deal with consumption and/or production linkages at a level of detail of the type contemplated for our project. For the most part only backward production linkages are included. Most empirical investigation of forward linkages adopts an aggregate input-output approach. The reason for this lacuna is probably that it is easier, with micro-studies, to capture the impact of changes in demand than that of changes in supply.

In what follows for each study we briefly summarize the approach adopted, the methodology employed and the results obtained. We present a brief comment on each study, in order to assist in the construction of our own approach.

1) King and Byerlee, "Factor Intensities and Locational Linkages of Rural Consumption Patterns in Sierra Leone," American Journal of Agricultural Economics, May 1978:

Summary: This paper asks the question: given an exogenous increase in agricultural income, what will be the linkage effects of rural consumer spending?

Methodology: A national rural household budget survey was used to estimate marginal propensities to consume for individual commodity groups. Factor intensities of these commodities were then calculated from a nation-wide industrial survey.

Results: Lower income families were found to spend an increase in income on a more labor intensive bundle of commodities than higher income families. Rural consumers also tended to purchase rurally produced goods.

Comment: The study does not look at production linkages nor at supply conditions.

2) Kilby, P. and B. Johnston, "Agricultural Strategy and Manufacturing," Stanford Food Research Institute Studies, 1972, pp. 155-175:

Summary: This paper attempts to obtain a rough idea of the quantitative impact of different agricultural strategies on the farm equipment industry with respect to value added, foreign exchange requirements, and employment.

Methodology: The inventory of implements found in irrigated wheat and rice farming was identified. The cost to the farm of original equipment and lifetime spare parts was ascertained

from field investigation and secondary sources. This cost figure was then divided by useful life and area serviced to arrive at a measure of annual equipment flow per acre. The different agricultural strategies were identified as (1) fully mechanized farming with tractor and combine; (2) farms using intermediate equipment centering around power tillers; and (3) improved bullock technology with stationary threshers. All packages included a diesel powered tubewell. The equipment flow, expressed in rupees per acre, of each of these strategies was then broken down into import content, taxes, distribution, and manufacture (see Table 1).

Results: Surprisingly, while strategies (1) and (2) are associated with a much larger total equipment flow, strategy (3) has the largest domestic manufacturing component, even if all equipment currently imported is ultimately produced domestically. Thus not only does mechanized farming displace labor and use capital more intensively but it also contributes less to manufacturing output. Moreover, the manufacturing process under strategy (3) is itself less capital-intensive than the manufacturing process for strategy (1) or (2). If adjustments for the differences between domestic and world prices are made, the advantage of strategy (3) increases further.

Comment: This is an excellent study of the first round linkages with capital goods following an increase in agricultural production. It is limited in that it deals with no other linkages or second round effects in detail.

TABLE 1

—Equipment Flow per Acre Under Various Agricultural Strategies, West Pakistan*
(*Rupees per acre*)

Equipment package		Total equipment flow	Import content	Taxes	Distribution	Manufacture
Tractor	A	129.4	64.4	21.3	33.7	10.0
(1–9, 25–29)	B	129.7	38.6	15.5	30.1	45.2
Power tiller	A	135.1	59.8	19.7	28.2	27.4
(20–23, 25–29)	B	135.1	45.2	18.1	25.4	46.4
Bullock (10–19, 22–23, 25–29)	B	83.9	21.9	8.8	4.2	49.0

* Data from Government of West Pakistan, Farm Mechanization Committee, *Report of the Farm Mechanization Committee* (Lahore, 1970) and personal interviews.

Numbers in parentheses refer to equipment items in Table 4. "A" refers to the current situation where tractors, tractor-drawn equipment, and tillers are imported. Under "B" all items are produced domestically.

3) Mellor, J. and U. Lele, "Growth Linkages of the new Foodgrain Technologies," Indian Journal of Agricultural Economics, January 1973.

Summary: This paper investigates the consequences of the fact that the addition to national income resulting from the new foodgrain technologies has accrued mostly to the relatively upper income classes in the rural sector. Only consumption linkages are investigated because, it is claimed, these are much larger than production linkages, while the domestic growth linkages from expenditure on inorganic fertilizer, which forms about one-third of extra expenditure for current production costs other than labor costs, are argued to be low because the fertilizer is either imported or produced with highly capital intensive techniques.

Methodology: The primary income distribution resulting from the introduction of new foodgrain technologies is estimated from some earlier studies. Linkages arising from consumption out of the extra income are estimated using consumption functions for different classes in rural India, derived by Desai (B.M. Desai, "Analysis of Consumption Expenditure Patterns in India," Occasional Paper, 54, Department of Agricultural Economics, Cornell University) from an Indian consumer expenditure survey, 1964-5. The effects of a 4% increase in foodgrain production brought about through the new technologies, in which benefits are concentrated on upper income groups, is compared with a similar increase resulting from traditional labor intensive techniques. Capital-labor

ratios for different industries are presented in order to consider the appropriateness of the industrial production resulting from the linkages.

Results: Studies of the distributional consequences of the new technologies showed that 10% of an increment in production went to labor, 23% to expenditure on other production costs, and 67% constituted a return to land and capital (see Table 2). It was assumed that all extra factor payments were consumed. While 59% of the extra consumption of laborers goes to foodgrains, according to the consumption functions, among upper income groups a much higher proportion is spent on items other than food grains, leading to a much larger linkage with non-food grain production, of which agricultural products are an important element (see Tables 3 and 4).

It was concluded that an increase in foodgrain production associated with the new technologies would have much higher linkage effects than traditional labor intensive methods. It was argued that the non-agricultural products demanded would be more labor-intensive than the average mix of production in India, because of differences between urban and rural consumption patterns.

Comment: This paper foresees great benefits in terms of employment-intensive linkages from increases in foodgrain production, especially if the income generated by those increases goes mostly to upper-income rural classes. However, there are some serious defects which would affect the

TABLE 2

INDIAN JOURNAL OF AGRICULTURAL ECONOMICS

DIVISION OF THE INCREASED "PAYMENTS" FROM A HIGH-YIELDING WHEAT VARIETY, ALIGARH DISTRICT, U.P., INDIA, 1967-68

Item	Traditional variety	High-yielding variety	Per cent increase
1. Yield (quintals)	7.5	14.8	96
2. Gross value of production (Rs.)	653	1,115	71
3. Payments (costs) other than family labour, land and capital (Rs.)	219	334	52
4. Payments for fertilizer (included in 3) (Rs.)	37	76	110
5. Payments (net return) to family labour, land and capital (Rs.)	434	781	80
6. Payments (net return) to family land and capital (Rs.)	380	690	82
7. Payments to labour (cost or imputed value) (Rs.)	80	126	59
(a) Family labour (Rs.)	54	91	68
(b) Hired labour (Rs.)	26	35	37

	Increments in shift from traditional to high-yielding variety	
	Rupees per acre	Per cent of increment to gross production
8. Gross value of production (row 2)	462	100
9. Payments to labour (row 7)	46	10
10. Payments (returns) to all inputs, including land and capital, but excluding labour (row 2 minus row 7)	416	90
11. Payments (costs) other than labour (row 3 minus row 7b)	106	23
12. Payments for fertilizer (row 4) (included in 11)	39	8
13. Payments (net returns) to family land and capital (row 6)	310	67

Source : Adapted from (6).

TABLE 3

Division of Incremental Expenditure among Expenditure Categories, by Rural Expenditure Class, India, 1964-65

	Bottom 2 deciles (Mainly) landless agricultural and non-agricultural labourers)	3rd decile (Labourers with less than 1 acre)	4th & 5th deciles (1-5 acres)	6th, 7th & 8th deciles (5-10 acres)	9th decile (10-15 acres)	Lower ½ of 10th decile (15-30 acres)	Upper ½ of 10 decile (30+ acres)
Mean per capita monthly expenditure	8.93	13.14	17.80	24.13	30.71	41.89	85.84
Allocation of an additional rupee of expenditure							
A. Agricultural commodities	0.79	0.69	0.59	0.52	0.46	0.40	0.33
(a) Foodgrains	0.59	0.38	0.25	0.16	0.11	0.06	0.02
(b) Non-foodgrains	0.20	0.31	0.34	0.36	0.35	0.34	0.31
(i) Milk and milk products	0.07	0.11	0.12	0.13	0.13	0.12	0.09
(ii) Meat, eggs and fish	0.02	0.03	0.03	0.03	0.03	0.03	0.02
(iii) Other foods (a)	0.01	0.05	0.07	0.09	0.10	0.12	0.16
(iv) Tobacco	0.01	0.01	0.01	0.01	0.01	0.01	0.01
(v) Vanaspati	@	0.01	0.02	0.02	0.02	0.02	0.01
(vi) Other oils	0.05	0.05	0.04	0.04	0.03	0.02	0.01
(vii) Sweeteners	0.04	0.05	0.05	0.04	0.03	0.02	0.01
B. Non-agricultural commodities	0.21	0.31	0.41	0.48	0.54	0.60	0.67
(a) Textiles	0.09	0.08	0.07	0.08	0.07	0.06	0.07
(i) Cotton textiles	0.09	0.08	0.07	0.06	0.06	0.05	0.03
(ii) Woollen textiles	@	@	@	0.01	0.01	0.01	0.02
(iii) Other textiles	@	@	@	0.01	@	@	0.02
(b) Non-textiles	0.12	0.23	0.34	0.40	0.47	0.54	0.60
(i) Footwear	@	0.01	0.01	0.01	0.01	0.01	0.01
(ii) Durables and semi-durables (b)	0.01	0.01	0.01	0.02	0.02	0.03	0.05
(iii) Conveyance (c)	0.01	0.01	0.02	0.02	0.03	0.03	0.10
(iv) Consumer service (d)	0.02	0.02	0.02	0.03	0.03	0.04	0.06
(v) Education (e)	0.01	0.01	0.02	0.03	0.03	0.05	0.11
(vi) Fuel and light	0.07	0.07	0.06	0.05	0.05	0.04	0.03
(vii) House rent (f)	—	0.01	0.01	0.02	0.03	0.04	0.08
(viii) Miscellaneous (g)	—	0.09	0.16	0.22	0.27	0.28	0.16
Total	1.00	1.00	1.00	1.00	1.00	1.00	1.00

@ Negligible.

Source: The estimated consumption functions are reported in a paper by B. M. Desai (5). The data source is from the NCAER "All-India Consumer Expenditure Survey 1964-65" (24). These data provide expenditure elasticities of foodgrains and milk and milk products consistent with those

TABLE 4

DISTRIBUTION OF RS. 240 CRORES EXPENDITURE ASSUMING TWO DIFFERENT DISTRIBUTIONS OF INCOME

(crore rupees)

Items	10 per cent of expenditure by landless labourers and 90 per cent by owner-cultivators†			20 per cent of expenditure by landless labourers and 80 per cent by owner-cultivators†		
	Labourers' expenditure	Cultivators' expenditure	Total expenditure	Labourers' expenditure	Cultivators' expenditure	Total expenditure
1. Foodgrains	10.8	34.5	45.3	86.4	7.7	94.1
2. Milk and milk products	2.4	28.1	30.5	19.2	6.2	25.4
3. Meat, eggs and fish ..	0.5	6.5	7.0	3.8	1.4	5.2
4. Tobacco	0.2	2.2	3.4	1.9	0.5	2.4
5. Vanaspati	0.2	4.3	4.5	1.9	1.0	2.9
6. Other edible oils ..	1.2	8.6	9.8	9.6	1.9	11.5
7. Sweeteners	1.2	8.6	9.8	9.6	1.9	11.5
8. Other foods	1.0	19.4	20.4	7.7	4.3	12.0
9. Cotton textiles	2.2	13.0	15.2	17.3	2.9	20.2
10. Woollen textiles ..	—	2.2	2.2	—	0.5	0.5
11. Other textiles . ..	—	2.2	2.2	—	0.5	0.5
12. Footwear	0.2	2.2	2.4	1.9	0.5	2.4
13. Conveyance	0.2	4.3	4.5	1.9	1.0	2.9
14. Consumer services ..	0.5	6.5	7.0	3.9	1.4	5.3
15. Education	0.2	6.5	6.7	1.9	1.4	3.3
16. Fuel and light	1.7	10.8	12.5	13.5	2.4	15.9
17. House rent	—	4.3	4.3	—	1.0	1.0
18. Durables and semi-durables	0.2	4.3	4.5	1.9	1.0	2.9
19. Miscellaneous	1.3	47.5	48.8	9.6	10.5	20.1
Total	24.0	216.0	240.0	192.0	48.0	240.0

† Landless labourers defined as the lowest three expenditure deciles and owner-cultivators as the sixth, seventh and eighth expenditure deciles.

Source : Computed from data in Table III.

conclusions. First, the study assumes that all factor payments are consumed. It seems probable that marginal consumption propensities differ, reducing the consumption linkage of upper income groups relative to laborers. Second, the method assumes that any expenditure on food-grains is a complete loss as far as linkages are concerned. However, positive linkages may occur within as well as between sectors. The effects depend on the local elasticity of grain production, and on the effects on income and expenditure of any consequent rise in food grain prices. Third, while the study provides evidence of very different propensities to consume different types of non-agricultural goods among different income groups, it does not make use of this information in analyzing subsequent linkages. For example, there are greater linkages with textiles for incomes generated among laborers, while upper income groups have a greater demand for durables, likely to be relatively more capital intensive and import intensive. Fourth, the study does not look at production linkages. In this respect, the paper is a good complement to Johnston and Kilby's which, it will be recalled, looked only at production linkages and came to the opposite conclusion. This contrast emphasizes the need to undertake a more comprehensive study of linkages before coming to any conclusions.

In both these papers, the linkages predicted are, of course, hypothetical in the sense that they are derived from

patterns of demand associated with an assumed increase in production, but are not observed in practice. This means that in each case they implicitly assume supply is infinitely elastic, i.e. that extra demand would be met at prevailing prices. This represents a very serious defect of the methodology, since one of the main questions to be answered is the conditions in which additional demands would call forth additional supplies. From a theoretical perspective, the approach taken is in complete contrast to that in some well known methods of cost benefit analysis (e.g. that of Little and Mirrlees) where it is assumed that additional consumption partially affects international trade, rather than only domestic supplies. Average industrial capital/labor ratios may not reliably indicate additional factor use, following linkages, for a variety of reasons including changing degrees of capacity utilization. Hence this element too needs to be observed rather than simply inferred.

The next two papers surveyed deal with actual situations, in which linkages stimulating domestic economic growth have been observed.

4) Child & Kaneda, "Links to the Green Revolution: A Study of Small-Scale, Agriculturally Related Industry in the Pakistan Punjab," Economic Development and Cultural Change, January 1975:

Summary: Agricultural output in West Pakistan grew at 3-6% during 1961-65, peaking at 15% in 1967-68. Backward linkages from this growth stimulated industries that provide agricultural

inputs. The study focussed on firms supplying tubewells for irrigation, and especially diesel-powered pumps for these wells. This industry sprang up entirely without government assistance and was unknown to government development officials.

Methodology: Interviews were conducted with a sample of firms. Estimates were made of the aggregate impact of the industry in terms of total number of production workers, employees, installed power capacity, value of lathes installed and value of a year's output. Attempts were also made to estimate total value added.

Results: The main findings from these interviews were as follows: (1) firms raised capital from family savings and reinvested profits with a working capital sometimes obtained from loans; (2) it appeared that the pricing policy approximated that associated with competitive markets; (3) major backward linkages included demand for coke, pig iron, sheet metal and copper tubing; (4) statistical tests showed few economies of scale, moreover; (5) import licensing was found to have led to raw material shortages which restricted production; (6) there was some technological adaptation of products.

Comment: A more detailed description of the linkage process itself is needed. This should at least include two elements: (1) the quantitative stimulus exercised by agricultural production growth on the industry under study; (2) the initial supply conditions (e.g. of the supply of skilled labor, entrepreneurs) which led to a positive supply response.

5) Ho, S., "Decentralized Industrialization and Rural Development: Evidence from Taiwan," Economic Development and Cultural Change, October 1979.

Summary: This consists of a quantitative study of decentralized industrialization in Taiwan.

Methodology: Existing data sources were used, especially the 1960 and 1970 agricultural censuses. Data was tabulated for annual growth rates of employment by industry (especially agricultural versus non-agricultural) and by locality (especially rural versus urban). Data was estimated for the distribution of employed persons by location, and manufacturing establishment, classified according to numbers of employees and by location. Estimates were made of capital intensity of manufacturing establishments by industry and location. Changes in income among farm households were analyzed.

Findings: (1) There was a major increase in income from non-farm sources among farm households which amounted to 25% of income in 1962 and had increased to 43% by 1975. This contrasts with S.Korea where the share remained constant at 23%. (2) This increase was more due to decentralized industrialization in Taiwan. Between 1956 and 1966, employment in rural manufacturing grew faster (at 7.2% p.a.) than employment in urban manufacturing. (3) On average, rural industrial establishments were smaller and more labor-intensive than urban establishments. (4) The increase in non-farm income had an equalizing effect on incomes since it was relatively greater for small farms. (5)

The factors favoring decentralized industrialization included technological developments in agriculture and government policies leading to the development of export-oriented agro-industry (a forward linkage); the existence of a high level of rural infrastructure, especially a good transport system plus a high degree of rural electrification; and a high level of primary education. (6) The expansion of rural industry in turn led to an increase in rural commercial and other service activities.

Comment: This study is important in pointing to the significance of infrastructure and government policies in promoting linkages. It also introduces forward linkages as well as consumption linkages. However, the linkages were inferred rather than quantitatively demonstrated. An important distinction emerges from this study between rural linkages and national linkages. In the previous studies, notably Johnston and Kilby and Mellor and Lele, the location of the linked non-agricultural activities was not identified. This distinction in location may be of importance for certain policy objectives, e.g. promotion of regional development, and also appropriate technology considerations, since rural industry tends to be more appropriate than urban. Moreover, as some studies below suggest, rural industrialization can have a favorable impact on agricultural productivity. Hence the location of linked activities forms another important dimension for study.

6) Aftab, K. and E. Rahim, "Entry and Survival: The Case of the Tubewell Industry in Pakistan Punjab," David Livingstone Institute of Overseas Development Studies, University of Strathclyde, Glasgow, October 1983.

Summary: This paper deals with the same industry that was studied by Child and Kaneda. Its focus, however, is different in that it seeks to explain the success that Child and Kaneda described.

Methodology: This effort represents a careful historical analysis of the period 1947 (Partition) to 1972 (Bhutto Government). A large volume of data on the growing demand for tubewells is presented.

Results: Three crucial factors contributed to the "burgeoning" of the tubewell industry in the 1960s:

1) The availability of a great deal of labor skilled in metal working. This supply was augmented by the Muslim migration of 1947.

2) The expansion of markets for water pumps, diesel engines, and electric motors due to a shift in government policy towards agriculture starting in 1959-60: the new policy improved the terms of trade between agriculture and industry and increased the volume of loans available to farmers for the purchase of tubewells and other inputs. Demand from the Water and Power Development Authority and other government sources also increased.

3) Skilled metal workers could up-grade their skills by working in large-scale plants set up after Partition as well as by attending technical and vocational training centers established by the central government. The large-scale firms

produced slow-speed diesel engines and centrifugal pumps with imported technology; these were diffused to their skilled workers, who were then able to set up smaller firms when demand for these products exploded in 1959-60.

4) An additional factor can be found in Falcon, W., "Agricultural and Industrial Relationships in West Pakistan," Journal of Farm Economics, December 1967, pp 1139 - 54 (esp. pp. 1148-51). Falcon states that "During the late 1950s, the Pakistan economy was subject to a very tight system of import licensing. Under this system, industrial firms (mainly large scale) were given specific rights to import materials. In the early 1960s, however, there was considerable liberalization, and many raw materials and intermediates were permitted to enter without a specification as to end use. ... Since... [small scale] firms were unregistered, it is unlikely that they would have been able to acquire the necessary raw materials had it not been for the increase in commodity aid and the change in import procedures."

Comment: A similar criticism could be applied to this paper as was applied to Child and Kaneda, i.e., it is not specific concerning the demand side of the agro-industrial linkage under study. However, once the calculations were carried out on the demand side to establish the hypothetical linkage, and other calculations were carried out on the supply side to see how well that linkage was realized, this paper provides an excellent example of how to proceed with the third step in the analysis — i.e. drawing conclusions about what preconditions and policies promote, or do not promote, successful linkages.

7) Bose, A., "Intersectoral Linkage in a Comprehensive Area Development Approach: The Case of West Bengal," World Employment Programme, Rural Industrialization and Employment Project, WP 11, April 1983.

Summary: Comprehensive Area Development Programs (CADPs) were applied to 19 districts in West Bengal, near Calcutta. The CADP approach was, in a nutshell, to free marginal and small farmers from dependence on money lenders and landlords by providing access to bank credit, help with marketing, and extension services.

Methodology: Six CADP districts were selected for intensive study. Estimates were made for a whole host of measures of agricultural performance and resource utilization, all of which were broken down for six types of households: landless sharecroppers, marginal farmers, small farmers, other farmers, artisans, and others. For the same types, estimates were also made of the total increase in income and the increase in the use of purchased industrial goods (current inputs, capital goods, and consumption goods). The paper studies a subset of three of the six districts, for which estimates were made of the increase in output and value added in nonfarm activities.

Results: The total value of agricultural production increased by 57.0% in the two-year period 1975-6 to 1977-8. This led to a 20.3% increase in the value of industrial goods purchased, with the biggest increase in expenditure on capital goods and the smallest increase in consumer goods (see Table 5). While the increases in total purchases of industrial goods were similar

TABLE 5

Estimated total use of purchased industrial goods by the households, 1975-76 and 1977-78 by type of families, in Rs.'000

Type	Current industrial input		Capital goods		Consumption goods		Total	
	1975-76	1977-78	1975-76	1977-78	1975-76	1977-78	1975-76	1977-78
Landless	372	669	51	78	6 366	7 428	6 789	8 135 (19.8%) *
M.F.	4 512	5 998	240	286	12 934	14 640	17 686	20 924 (18.3%)
S.F.	4 443	5 587	247	419	6 044	7 287	10 734	13 293 (23.8%)
O.F.	2 994	3 576	143	411	2 683	3 129	5 82C	7 116 (22.3%)
Others	490	612	96	68	8 991	10 733	9 577	11 413 (19.2%)
Total	12 811	16 442	777	1 222	37 018	43 217	50 6C6	6C 881 (20.3%)

Note: (1) This table deals with goods purchased by the category of farmers concerned and may differ from goods (particularly) inputs used as some of it, say, for sharecroppers might have been advanced by the landowner or some of it, say compost, might not have been purchased.

(2) In current use of industrial input, price of only diesel, power, etc. used for irrigation water has been taken into account.

* Figures in brackets denote % increase during 1975-76 to 1977-78.

for all types of farm households, the larger farmers increased their purchases of capital goods the most, while the landless farmers increased their purchases of current inputs the most. In the subset of three districts surveyed the value of nonfarm output increased by 50.7% and the gross value added increased by 75%.

Comment: Because of the differences in the areas surveyed, it is impossible to link the estimates of increased demand for nonfarm output with the estimates of increased supply. An excellent opportunity was lost here, probably because the main focus of the study was on the effect of the CADPs on agricultural performance.

One crucial question of methodology implicitly raised by the papers surveyed thus far relates to the question of whether one wants to look past the first "round" of consumption and production linkages? For example, Mellor and Lele examine the input demand created by producing the goods consumed by the earners of the income generated by new agricultural technology. If they had gone on to see what final goods were demanded by those who produced these consumer goods, they would have studied a complete "second round" of linkages. In theory, one could also abstract from the problem of rounds by using a multiplier analysis which deals with the convergence of an infinite sequence of rounds.

The normal multiplier expresses effects in terms of aggregate changes in consumption. It does not give details of industrial composition, distributional effects or of factor use associated with subsequent rounds. Since the value of

the multiplier itself will be affected by these details, the use of a multiplier inevitably represents a rather rough short cut approach. It does not incorporate accelerator or investment effects. Where the information is available, it could be supplemented by use of a Social Accounting Matrix (SAM), which would provide details of industrial composition and distributional effects. If a SAM, or even a simple input-output table, is available, the analysis of linkages would be considerably facilitated, though in general these accounting matrices represent average, not marginal, relationships.

One major recent effort which moves substantially in this direction is an IFPRI supported study:

8) Bell, C., P. Hazell and R. Slade, Project Evaluation in Regional Perspective, The Johns Hopkins University Press, Baltimore, 1982

Summary: This book attempts to extend the evaluation of a project to cover the effects that the project has outside of the project area. The case study chosen for the book was the Muda Irrigation Project in a relatively poor agricultural region of northwest Malaysia devoted primarily to rice cultivation.

Methodology: This book represents a major methodological advance over the previously surveyed empirical literature dealing with the linkage effects of agricultural productivity increase (items 1-7 in our literature survey). The approach of the previous literature was to calculate input coefficients for agricultural production and farm household consumption at a point in time, and use these average relationships to estimate the production and consumption linkages resulting from increased agricultural productivity and resulting in increased

farm household income. The approach of Bell et. al. is to estimate behavioral equations determining input and consumption demands. The gain from the latter approach is that prices, and substitution effects in response to prices, can now be endogenous to the model. The previous literature implicitly assumed that prices were fixed or that production and consumption coefficients were fixed. The great drawback of the new approach is the enormous increase in the information and statistical work required. In the Preface the authors state that, "The study began in 1972 .... After two years of field work in Malaysia, analysis commenced in Rome in 1974.... Intensive research continued in Washington until 1979 and resulted in this book."

We now proceed to a more detailed examination of the methodology. In the Introduction, the authors set out their rationale for adopting such an expensive method:

> Irrigation has made it possible to grow two crops a year instead of one. Thus, if farmers could carry out the same schedule of operations twice in the twelve-month calendar, with labor and other inputs available at constant costs, predicting the direct effects of the project would be trivial. The paddy farming economy would, in effect, be simply replicated; in an annual accounting all inputs, outputs, costs, and revenues would double without affecting the distribution of income among farmers, landlords, and farm workers.
>
> In fact, no such simple replication was possible. Growing two crops a year makes for a more hurried rhythm of cultivation; as one crop is harvested, the land is quickly tilled again and then planted to the next. Thus, any tightness in the supply of labor will manifest itself in a rise in wage rates. This is exactly what happened. But if wage rates rise, it may become cheaper to prepare the land with tractors than with buffaloes, and, with a fixed supply of land, rents will be affected too. Since all these variables are simultaneously determined, a formal model is needed to estimate the effects of the project upon them. (pp. 5-6)

The information needed to describe the paddy farming economy is gathered in Chapter 2, which by itself goes as far as the previous literature referred to above. A formal model of that economy is "built, tuned, and tested" in Chapter 3.

Later chapters replicate, respectively, the analysis of chapters 2, 3, and 4 for the "downstream" economy, i.e. for the economy outside the immediate project area that is linked to it by production and consumption linkages. A regional Social Accounting Matrix (SAM) is then constructed that already goes far beyond the descriptions of the "downstream" economy that were included in the previously surveyed literature and is used as the basis for estimating a regional "semi-input-output" model.

An heroic effort is made to disentangle the contributions of the linkage effects of the project from autonomous changes in (1) the output of traded goods other than paddy, (2) investment and current outlays by the government, and (3) the prices of tradables. finally, a formal cost-benefit analysis of the irrigation project is presented that attempts to account for the effect of the project and its regional linkages on the entire economy, including any loss to the rest of the economy due to the withdrawal of resources to the expanding region.

Results: The SAM for the regional economy showed the linkages connecting production activities to be weak, but consumption linkages to be strong because households were found to spend a

large fraction of their incomes on locally produced goods.

Primarily as a result of the household expenditure linkages, for every dollar of value added generated directly by the project, another 80 cents were generated downstream. Most of the value added downstream accrued to non-farm households. Yet in the absence of the project, the distribution of income between paddy farming households in the irrigation command area and the other households in the region would have worsened considerably, for the autonomous changes overwhelmingly favored townspeople. As it was, aside from the changes in the region's terms of trade, paddy farming households were doing better in 1974 than in 1967 both relatively and absolutely.

Comment: The results just cited substantiate the claim of Mellor and Lele (see item 3 of this survey), also made in the context of a project to raise foodgrain productivity in an Asian country, that consumption linkages are more important than production linkages. It should also be noted that Bell et. al. represents the only study we have surveyed that was able to explicitly account for financial flows.

The limitations of this substantial effort are also clear. Causality flows only one way — from the agricultural sector to the non-agricultural sector, from the hinterland to the enclave. Causality in the other direction, which is covered by papers 9 - 15 in our literature survey, is ignored. Ideally, we could model all linkages at the same level of

sophistication at which the farm-to-industry linkages were modelled in this book. The result would be a simultaneous-equations behavioral model that is theoretically and empirically satisfying. However, the task would roughly double the seven year period that Bell and company required.

A potential work-saving device suggested is the semi-input-output model. The flexibility of this model relative to a behavioral model of the type used in chapter 3, and the degree to which this model can be an improvement over the basic SAM, remains to be studied.

There are other interactions between agricultural and industrial development taken up in this general literature that are worth considering:

9) Tang, A. Economic Development in the Southern Piedmont, Chapel Hill: University of North Carolina Press, and

10) Nicholls, W., "Industrial-Urban Development as a Dynamic Force in Transforming Brazilian Agriculture, 1940-1950," in E. Thorbecke, ed., The Role of Agriculture in Economic Development NBER, New York, 1969:

Summary: Both these studies are devoted to testing T.W. Schultz's proposition that nearby industrial-urban growth reduces the imperfections in both factor and product markets faced by agriculture and hence raises farm income per worker and, as the title of Nicholls' paper suggests, leads to the transformation of traditional agriculture. Their work may be grouped together because they use essentially the same methodology and obtain the same kind of results, even though they are concerned with very different geographic areas.

Methodology: Per capita value added in manufacturing was used as the index of industrial-urban development. Different census zones (e.g., counties) were ranked in terms of this index. Rank correlation coefficients with this index were calculated for a large number of other indices of nonagricultural development and agricultural and population characteristics. For example, the positive correlation of cash-crop production with urban-industrial development (as measured by value added in manufacturing) and the negative correlation of subsistence crop production were taken to have demonstrated the effect of the proximity of urban markets.

Results: It was found that industrial-urban development (1) led to better roads and more efficient marketing facilities; (2) created a demand for highly perishable commodities such as fluid milk and fresh vegetables that were more profitable than traditional products; (3) improved credit access for rural areas, resulting in increased short-term farm loans and capital per worker employed in agriculture; (4) raised the opportunity cost of labor and ultimately precipitated farm reorganization. A major policy recommendation arising from Tang's book was that there should be more geographic decentralization of industrial-urban development in LDCs to prevent rural poverty.

Comment: If not used carefully, this method is open to the charge of reverse causality. For example, in the example of cash-crop production (in Nicholls' paper) above, one could argue that the correlation demonstrates that urban-industrial development was financed out of coffee-growers' profits. Another problem

is that much of the evidence presented to support the hypothesis that capital market imperfections were reduced can be interpreted as a straightforward transfer of capital from industry to agriculture. Nevertheless, this body of work provides partial evidence on the way linkages work and on their importance in promoting economic development.

The next two papers test the Schultz hypothesis using the same methodology as Nicholls and Tang; we will therefore only report their results here.

11) Ruttan, V., "The Impact of Urban-Industrial Development on Agriculture in the Tennessee Valley and the Southeast," Journal of Farm Economics, March 1955, pp. 38-56. Ruttan concentrates on the Tennessee valley and the Southeast because it is clear that in this region urban-industrial development has raised the level of farm family income. By contrast, in the Northern Great Plains area of the United States there is some evidence that the level of income achieved by nonfarm families is a function of the level of income achieved in the agricultural sector, thus reversing the hypothesized causality.

For the Tennessee valley and the Southeast, Ruttan finds that "the major impact of urban-industrial development on the median incomes of farm families is exerted directly through the participation of members of farm families in nonfarm employment." This participation has a greater effect than the level of earnings in nonfarm employment. Moreover, the impact of urban-industrial development on labor productivity in agriculture is less than its impact on median farm family income.

Ruttan finds (weaker) evidence that the level of capital inputs

per farm worker is related to industrial-urban development. Moreover, the evidence that the functioning of the farm product and current input markets is related to urban-industrial development is found to be the weakest of all.

12) Sisler, D., "Regional Differences in the Impact of Urban-Industrial Development on Farm-Nonfarm Income," Journal of Farm Economics, August 1959, pp. 1100-1112. Sisler's most significant finding is that the positive influence of urban-industrial development on agricultural income does not hold on the West Coast of the United States, despite the substantial off-farm employment of farmers. He cites three possible reasons for this finding. (1) Much nonfarm activity in this region may be associated with lumber operations. (2) In 1950, the year for which data were used, the West had few urban areas; therefore, the county indicators of urbanization may have been misleading because the pull of the urban areas that did exist crossed country lines. (3) Water availability was probably more important to agricultural prosperity in this region than nearby urban-industrial growth.

The next paper includes a clever test of the hypothesis that factor markets "work better" adjacent to areas of relatively faster urban-industrial development.

13) Hathaway, D., "Urban-Industrial Development and Income Differentials Between Occupations," Journal of Farm Economics, February 1964, pp. 56-66.

Method: The median income of males classified as factory operatives and males classified as farmers and farm managers was compared using 1960 U.S. Census data. It was assumed that smoothly functioning labor markets would tend to reduce income differentials in favor of

factory operatives to the level caused by differences in skill, etc. If labor markets function better near urban-industrial areas, the operative-farmer income differential should increase as the distance from such areas increases.

Results: The income differentials did not increase as the distance from urban-industrial areas increased, thus rejecting the hypothesis as far as the labor market is concerned.

The next paper marks a great improvement over the Nicholls-Tang method for testing the Schultz hypothesis.

14) Bryant, W., "Causes of Inter-County Variations in Farmers' Earnings," Journal of Farm Economics, August 1966, pp. 557-577.

Methodology: For different regions of the United States, the median earnings of farmers by county were regressed on the following explanatory variables: percentage of nonwhite farmers, farmers' age, farmers' education, percentage of unemployment in the county, percentage of operatives and craftsmen in the county labor force, value of real estate per farm, and distance to the nearest Standard Metropolitan Statistical Area (SMSA). The advantage of this method is that all but the distance variable can be made to account for any direct provision of human capital, physical capital, or jobs by the nearby urban-industrial area, thus leaving the residual "distance from SMSA" variable to pick up any benefit due to the better working of factor and product markets. According to the Schultz hypothesis, distance from SMSA should have a negative and significant coefficient in the equation explaining median earnings of farmers.

Results: Percentage of unemployment almost always had a strong negative effect while the value of real estate had a strong positive effect. Most probably these two factors picked up the effects of urban proximity that were most important since the distance from SMSA variable was only significant for the United States east of the Mississippi. (Note that this is consistent with the results of both Ruttan and Sisler.) In addition to the reasons for this result suggested by Sisler, Bryant notes that Western farmers produce for national markets while many Eastern farmers (i.e., dairy farmers) produce for local markets.

Comment: We can summarize what we have learned from the investigations into the Schultz hypothesis as follows. Imagine a region of smallholders growing rapidly perishable products. Now locate an industrial center within transport range (i.e. before the products spoil) of only part of the region. Farmers in that area will have bigger and better markets for their products, giving them incentives to expand production. They will also gain access to education/information about new techniques to help them expand production, and better credit facilities to allow them to invest in the new techniques. Since they are smallholders, they cannot completely occupy their time on the farm; thus they take jobs in the industrial center, thus increasing their income. This describes what may have happened in parts of the United States east of the Mississippi.

Now suppose the farmers' products are non-perishable (e.g., grain), and a good transport network exists. The advantage of the

industrial center in providing a bigger and better market disappears. Next, suppose there is an efficient agricultural extension service. The advantage of the industrial center in providing education/information disappears. Next, suppose there is a good rural development bank. The advantage of the industrial center in providing credit disappears. Finally, suppose the farmers are not smallholders, or that there are rural off-farm employment opportunities such as mining and lumbering. The advantage of the industrial center in providing off-farm employment disappears. This is the situation in much of the United States west of the Mississippi, which is why all the studies found no positive effect of industrial-urban development on farmers' incomes in this region. We should note the possible analogy between different parts of the U.S. and developing countries at different stages of development.

We should also note the crucial importance of transportation in the above scenario. Without the availability of transportation to the urban-industrial area, in the case of perishable products, or to other regions or ports, in the case of non-perishable products, a wider market will not be available to farmers and their incentives to expand production, and to acquire the necessary human and physical capital, will not exist.

Some excellent anecdotes about the benefits of transportation to poor farmers are presented in the beginning of Glover, D. and J. Simon, "The Effect of Population Density on Infrastructure: The Case of Road Building," Economic Development and Cultural Change, April 1975, pp. 453-468 . Here it is claimed that the transport system in being will have a bearing on the realization of many of the linkages

discussed above, i.e. whether the consumption linkages are met by local rural industry or urban centers will be affected by the transport system. The existence and location of forward linkages from agriculture is similarly affected, as indicated in the Taiwan study. It will, therefore, be important to identify and measure the availability of transport in empirical studies.

In several studies, paved and unpaved road density, railway density, on both a per area and per population basis, have been used as measures of transportation availability (e.g., Owen, W., Strategy for Mobility, Washington, D.C.: The Brookings Institution), 1964).

The question of distance and transport costs is also covered in another valuable paper:

15) Martin Katzman, "The von Thunen Paradigm, the Industrial-Urban Hypothesis and the Spatial Structure of Agriculture," American Journal of Agricultural Economics 56 (November 1974): 683-96.

Summary: von Thunen, a German economist of the early 19th century, developed a simple model described by Katzman as follows: "Production takes place in a uniformly fertile plain in which exists a market center. The staple must be shipped to this market in order to be sold. The net price received by the farmer equals the market price less transport costs from farm to market. Shipping the staple from farm to market from greater distances entails higher costs." With declining marginal products of factors it is obvious that capital and labor inputs per acre, and therefore output per acre, will decline with distance from the center. If we add the assumption, often made (and demonstrated) by the industrial-urban theorists cited above, that wages increase and/or interest rates

decrease with proximity to the center, then we get the additional results that capital/labor ratios and the value of output/labor ratios decline with distance from the center.

These are precisely the predictions that the industrial-urban hypothesis makes regarding farm activity, as distance from the industrial-urban center increases, although the industrial-urban hypothesis also predicts that technological progress or total factor productivity will decrease with distance from the center. Katzman's point is that the two hypotheses complement each other and form a powerful analytical tool.

Methodology and Results: Katzman collected data for the state of Goias in Brazil for the period 1940-1970. He showed that, as the von Thunen hypothesis predicts, the prices of rice and raw meat (the staple exports of the state) are inversely proportional to distance from the state capital, Goiania. The same is true of land values. Because industrial-urbanism (measured by the manufacturing wage bill per capita) is not perfectly correlated with access to Goiania, its effect can be tested independently. Industrial-urbanism was found to have a consistent positive effect on the capital-labor ratio and capital-land ratio in agriculture, while distance from Goiania had a consistent negative effect on these same ratios. Thus Katzman's proposition about the complementarity of the industrial-urban and von Thunen hypotheses was confirmed. Data for output was too scanty to support any conclusions about total factor productivity, output per man, or output per hectare.

The last two papers surveyed are also likely to be of relevance to our study.

16) Ho, S., "The Simple Analysis of Proto-industrialization and Deindustrialization," paper presented at the 8th International Congress of Economic History, Budapest, August 1982:

This paper makes the point that a peasant household will equate the marginal product of its labor in agriculture and industry, so that members will work more in agriculture in the harvest season and more in industry in the slack season. Any development (e.g. an increase in the price of agricultural goods) that increases the marginal product in one activity must increase the amount of labor devoted to that activity and decrease it in the other. Thus, if we want to check the linkage effects of an exogenous increase in agricultural income, we must determine if the cause of that increase has altered the relative profitability of working in agriculture versus industry because this could significantly influence the strength of the linkage effects, from the point of view of supply.

17) Ho, S., "Small-Scale Rural Industries in Contemporary Economic Development: the Cases of South Korea and Taiwan," paper presented at the 8th International Congress of Economic History, Budapest, August 1982:

This paper shows that technological progress in Korean and Taiwanese agriculture raised the marginal product of slack season work in agriculture and thus led to a reduction in rural non-agricultural activity. Working against this trend was increased population pressure that reduced the marginal product of labor on land. Ho illustrates the importance of rural non-agricultural activities by tabulating, for Korea and Taiwan, the distribution of employed persons in rural areas by industry and as a share of total employed persons. He also enumerates persons with sideline activity by location, industry of main occupation,

and industry of the sideline activity. In contradistinction to most developing countries, more than 50% of farm family income in Taiwan comes from such non-agricultural rural activities.

SUMMARY

This survey of some of the most relevant literature has provided many insights for our own study. To summarize briefly:

1. A comprehensive study needs to look both at additional demand arising from an increase in agricultural output, and at conditions of supply, determining how far additional demand is realized in changes in domestic output.
2. As far as demand is concerned, there are three important elements - demand for consumption goods, recurrent expenditure on inputs, and capital expenditure. For any given increase in agricultural output, additional consumption demand is likely to vary according to the distribution of income associated with the extra output; demand for capital and inputs are likely to vary according to the type of farm (organization and scale), associated with the extra output. There may also be variations according to crop. Any study of linkages, therefore, needs to examine all these elements.
3. As far as supply is concerned, there is an important distinction between linkages involving a local supply response and one which involves extra industrial supplies emanating from distant urban centers, especially if the aim is to study conditions for successful local balanced growth. Second round effects within a given region are obviously likely to be

greater if the linkages result in extra local supplies. While this location distinction is important, it will create problems of definition and measurement, since there may not be well defined regional boundaries and regional statistics are usually weak.

4. The review has suggested the following factors as influencing the extent of a local supply response: supply of local entrepreneurs; levels of education and skills; access to own savings and/or credit; infrastructure, including electrification, information services and transport.

5. The nature and quality of the transport system was revealed as being of considerable and rather complex significance. A good transport system would facilitate forward linkages (as in Taiwan), but could also reduce them (as in the U.S.); much depends on the size and dispersion of the population.

6. Two-way causality has been suggested with local industrialization raising agricultural productivity, as well as being a response to it. This effect could be the result of improved incentives (better markets for products), improved access to capital and technological information, and, possibly, a general 'modernizing' ethos which accompanies close association with an industrial center. Such a positive reverse linkage could lead to a dynamic interaction between agriculture and industry. An important subject for study, therefore, is the extent and causes of such interaction.

7. Given the multiplicity of factors to be studied, a series of comparative studies would be required to permit more precise conclusions about causality, a necessary condition for the discussion of policies.

III Functional Approach to Dualistic Interaction

There are many dimensions to the linkages between agriculture and non-agriculture, as indicated in the above literature survey. Different dimensions acquire prominence at different stages of development. There are two reasons why these relationships are of paramount significance in the course of development. First, agricultural products and non-agricultural products are different in kind and cannot substitute for each other. Food is an essential conponent of consumption in both sectors, while the industrial sector provides inputs for both sectors, and a part of consumption. Non-agricultural products account for an increasing proportion of total consumption as household incomes rise and constitute an essential incentive for rising agricultural production. Secondly, the agricultural sector dominates the economy at an early stage of development in terms of both employment and output. The performance of the agricultural sector thus conditions aggregate development possibilities, as a source of savings, foreign exchange earnings, a market for non-agricultural products and labor. Industrialization is an intrinsic part of economic development, and both these elements become of lesser significance as aggregate incomes rise. While non-substitution between the sectors remains, foreign trade provides a mechanism whereby industrial production may be converted into agricultural consumption, and the agricultural sector becomes of lesser significance to the economy as a whole as countries develop and industrialize. Many of the major early linkage functions of the agricultural sector - savings, foreign exchange, markets - are later increasingly fulfilled by the industrial sector itself. Some of these changes are indicated by the statistics in Table 6 below. Hence our analytic work and empirical research need to take

TABLE 6

Agriculture as Percentage of Total

Country Group	No. of Countries	Labor Force (1980)	Gross Domestic Product (1981)	Merchandise Exports (1980)
India and China	2	69	33	30
Other low income	32	73	45	62
Lower middle income	39	55	22	38
Upper middle income	21	30	10	23
Industrial economies	19	6	3	15

Source: World Development Report, 1983

the stage of development into account. While the aggregate significance of agriculture diminishes at later stages of development, the nature of linkages acquires considerable importance in determining the pattern of industrial and agricultural development in terms of balance, choice of technology, employment, and spatial dimensions, as we shall elucidate in the discussion which follows.

3.1 An Aggregate Operational Perspective

Diagram 1a provides an operational perspective of a dualistic economy showing the interrelationships between the agricultural and non-agricultural sectors, in a closed economy. These have each been divided into a production sector and households. Intersectoral linkages at this level of aggregation may be classified into three types, as shown by the three circles in the middle of the diagram: i) intersectoral commodity exchange; ii) intersectoral finance, and iii) intersectoral labor migration. In this diagram, the arrows indicate the direction of the flow of monetary payments - with flows in the opposite direction implying the movement of real goods and services.

Beginning with intersectoral commodity exchange, we may note that a part of the total output of the agricultural sector (A) goes to the agricultural households for self-consumption (A_a) and a part flows to (i.e. is purchased by) the non-agricultural households, a flow labelled as TAS, or total agricultural surplus. This, it is important to note, is a commodity surplus not equivalent to agricultural savings. Similarly, total output (Q) of the non-agricultural sector is partly consumed by the non-agricultural households (Q_q) while the rest of the non-agricultural output takes the form of investment goods (I), agricultural and

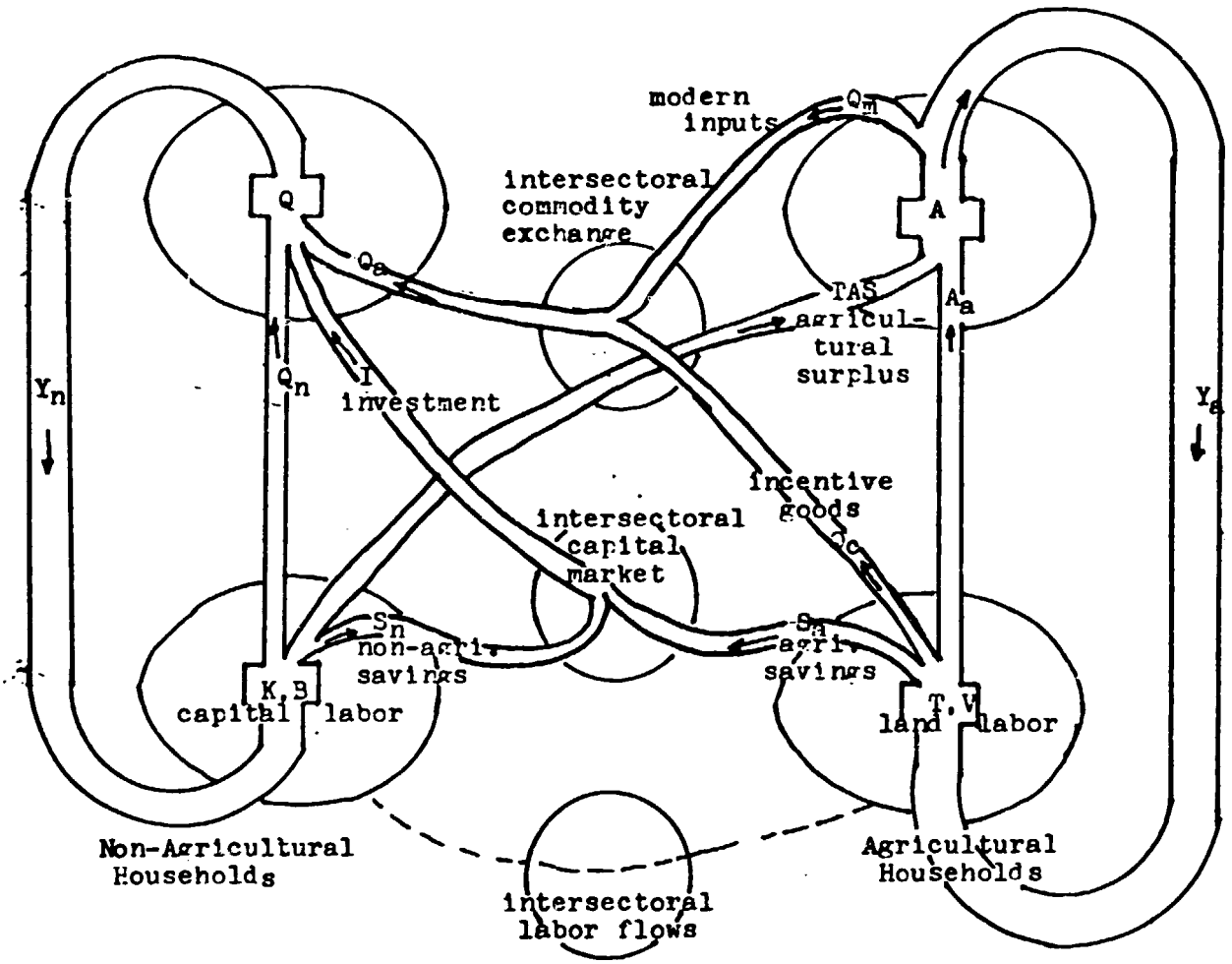


Diagram 1a Operation of Dualism

non-agricultural, or of goods purchased by the agricultural sector Q_a, through the intersectoral commodity exchange, This component, or Q_a, is further divided into a portion that provides modern intermediate inputs into agriculture (Q_m) and a portion which provides consumer goods (Q_c) for agricultural households.

The agricultural production sector makes factor payments for land and labor (Y_a) as well as payment for modern inputs (Q_m). The income received by agricultural households is either spent on consumption (A_a + Q_c) or savings S_a that flow into the finance sector. Similarly, for the non-agricultural household sector, factor payments (Y_q) are either consumed (Q_q plus TAS) or saved (S_q). S_a and S_q together constitute the total savings funds of the economy that "finance" investment in a closed economy.

In addition to commodity and financial flows, intersectoral labor movement occurs, i.e. the reallocation, over time, of a portion of the agricultural labor force (V) to the non-agricultural sector, as non-agricultural labor (B), through the intersectoral labor market. Intersectoral linkages or interactions at the aggregate level must be concerned with the way these economic functions are carried out.

3.2 Interactions Significance of Agricultural Modernization

In the early stage of development, the total agricultural surplus (TAS) represents a crucial concept in the development of a dualistic economy in that the appearance of TAS is an essential prerequisite for the growth of the non-agricultural sector. Without such a surplus, in the closed economy, a shortage of food would prevent sustained reallocation of labor from the agricultural to the non-agricultural

sector.

A portion of the incomes earned in the non-agricultural sector is utilized, as we have seen, to purchase the food "left behind." At the same time, agricultural households will purchase some of the new non-agricultural goods now being produced. The agricultural sector, therefore, in addition to providing saving and a supply of labor, also provides much of the demand for non-agricultural products, as well as essential supply of agricultural products to the non-agricultural sector.

In a closed economy, in the early stage of development, the magnitude of TAS is therefore critical to the development of the non-agricultural sector. TAS is the difference between agricultural output and the consumption of agricultural products within the sector. The main determinant of TAS is the level of agricultural labor productivity ($p=A/V$). The surplus of production over consumption of agricultural producers is directly related to p since the consumption of food declines as a proportion of income as income rises. For any given level of labor productivity, TAS is larger or smaller depending on the level of fod consumption by agricultural households. A sustained increase in TAS requires a sustained increase in agricultural labor productivity, p. In this context, we see the importance of the various approaches which help us to understand agricultural performance.

The physical inputs school of thought emphasizes the contribution of modern inputs from the non-agricultural sector (Q_m), in conjunction with modern science and technology, embodied in the Green Revolution technology. Modern inputs permit a consistent and rapid increase in agricultural productivity, in contrast to the slow growth associated

with traditional technology. Hence linkages - in the form of technology and inputs from industry to agriculture - permit growth in agricultural productivity, which, in turn, generates a demand for industrial products and a supply of agricultural products for the non-agricultural labor force.

The technological focus of the physical inputs approach often means neglecting the question as to why this process of the infusion of modern inputs does not occur on a sustained basis. Such failure is related to the institutional and incentive issues emphasized by the organizational school. One important dimension of this problem concerns the availability of industrial incentive goods to the agricultural household. The availability of such manufactured products extends people's economic horizons and hence enhances their motivation for taking those risks which are involved in experimenting with the use of new inputs and technology in the effort to increase agricultural productivity.

3.3 Agricultural/Non-Agricultural Linkages, Technology and Income Distribution

The extent and nature of linkages between agriculture and non-agriculture help determine the type of industrialization that occurs. In a closed economy, goods and services provided by the non-agricultural sector may be divided into the following categories, as noted above:

Q_g: Goods retained within the industrial sector

(i) investment goods and intermediate goods

(ii) consumption goods. These may be further subdivided into mass produced goods for low-income wage earners; and elite consumer goods for high-income households.

Q_a: Goods sold to the agricultural sector

(iii) investment goods and intermediate goods

(iv) consumption goods for agricultural households.

The choice of technology in the non-agricultural sector depends (among other factors) on the broad category of goods produced, and on the choice of products within each category. The choice of technology has implications for employment and the distribution of income, with more labor-intensive technologies being associated with a wider spread of income earning oportunities and a more equal income distribution. The pattern of income generated by the productive process thus has implications for choice of product and technique in the next period.

It is helpful to consider industrialization (or, more broadly, non-agricultural production) as divided into two parts - rural and urban. (In fact, we include small towns as rural, and will adopt a more detailed spatial classification in Section IV) The distinction is important for the analysis of balanced growth for three reasons: first, rural industries tend to be associated with more small-scale and labor intensive techniques than urban industries, and with simpler and more low-income type products. Secondly, rural industrialization generates incomes among rural households, often incorporating some labor from households that are primarily agricultural, which has implications for the pattern of demand in the next period. Thirdly, rural non-agricultural activity may have a positive effect on agricultural productivity (as suggested in Section IV.)

There is a general presumption that industrial goods sold to the agricultural sector, Q_a, will be associated with more labor intensive technologies than goods sold within the industrial sector, and with a higher element of rural as against urban industrial production. One reason why this is so is that transport costs raise the total costs of large scale production relative to those of small scale production for rural consumers. In addition, the consumption patterns of agricultural households are likely to be towards more low-income and simple products, involving labor intensive technologies, because household incomes of agricultural producers are typically lower than those of urban households. However, how patterns of consumption, and associated technologies, change over time depends on how the distribution of income in each sector changes over time.

Income Distribution and the Patterns of Consumption: We may divide rural households into n families, F_1^r, F_2^r, F_3^r....F_n^r. Associated with each family is a certain income stream (Y_1, Y_2, Y_3, ... Y_n) arising from agricultural and non-agricultural activities. Income from agricultural activities consists of income arising from land-ownership (t_1, t_2, t_3, ... t_n) and from labor in agriculture (w_1^a, w_2^a, w_3^a, ... w_n^a). Income from non-agricultural activities is made up of income from capital (π_1, π_2, π_3, ...π_n) and income from labor (w_1^q, w_2^q, w_3^q, ... w_n^q). The distribution of income from agriculture is likely to be greatly influenced by the distribution of land.

Family income of rural households is spent on food, a, on non-agricultural goods produced in the rural areas, q', on non-agricultural mass-produced goods produced in the urban areas, q",

and on 'elite' consumer goods, produced in the urban areas, q"'. In addition, the family may save, so that for every family:

$$Y_1^r = a_1 + q_1' + q_1'' + q_1''' + s_1$$

or $$Y_n^r = a_n + q_n' + q_n'' + q_n''' + s_n$$

The propensities to spend on the various categories alter with income. Expenditure on non-agricultural products tends to rise with income. Expenditure on rural consumer goods, q', and on mass produced urban goods, q", will tend to rise initially as income rises. However, once income rises beyond a certain point, expenditure on rural consumer goods may fall, and at higher income levels there may be a switch away from mass-produced consumer goods towards elite goods. (The data from Mellor and Lele in the literature survey illustrates some of these changes). Diagram 1b illustrates these relationships for rural households.

A similar analysis applies to urban households, F_1^u, F_2^u ... F_n^u (see Diagram 1c), but in this case sources of income for each family are non-agricultural (wages and profits), while expenditure would not usually include goods produced in the rural areas, so that:

$$Y_n^u = q_n'' + q_n''' + s_n$$

Each category of consumption (q', q", q"') is associated with a particular technology, while each technology is associated with a particular pattern of incomes. More empirical evidence is needed on the technologies, but there is a general presumption, on the basis of a priori reasoning and some evidence, that q' is more labor intensive and small scale than q", and q" is more labor-intensive and with a lower minimum efficient scale than q"'. Moreover, if we relax the assumption of a closed economy, the technology asociated with q"' will tend to be

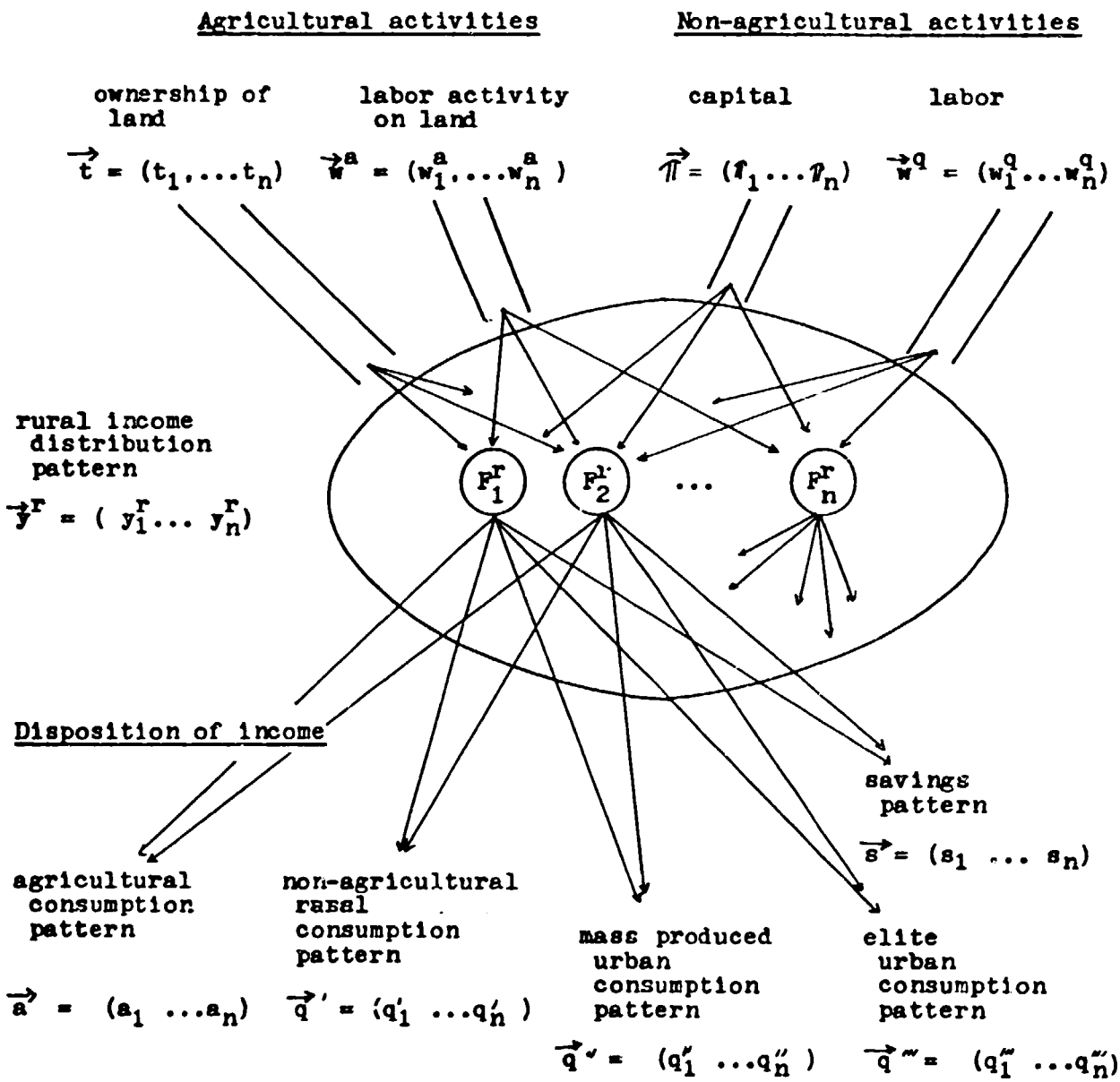


Diagram 1b : Rural Households

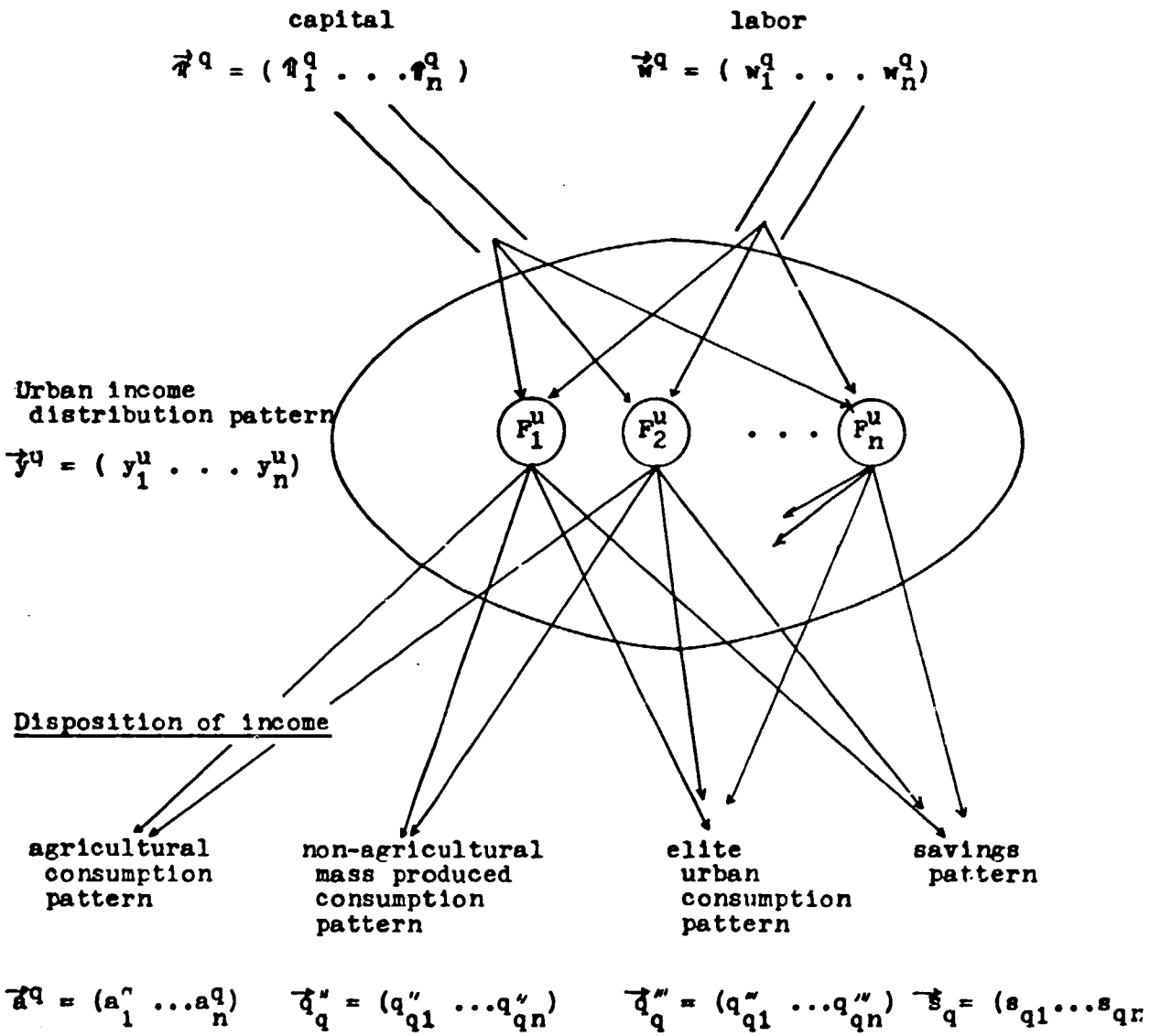


Diagram 1c : Urban Households

heavily reliant on imported technology and be more import intensive than q", which, in turn, will be more import intensive than q'.

It follows that dynamic reinforcing patterns of consumption and production may occur. For example, suppose there is an increase in agricultural output which is fairly equally distributed, in terms of extra incomes, among rural households. This would be associated with extra demand for the products of rural industry and for mass produced urban goods. The extra rural non-agricultural activity will further raise rural incomes and therefore consumption, while additional labor incomes generated by the expansion of demand for mass produced urban goods will increase the demand for agricultural products and for mass produced urban products. Hence, a virtuous circle may develop of increasing demand and supply of agricultural products, rural non-agricultural products and mass produced urban products. This would be associated with increased participation of the underemployed in production and consumption.

This virtuous circle can proceed only so long as it is not interrupted by supply bottlenecks. One such potential bottleneck would be a limit on the supply of food. This was noted earlier, in focussing on the growth of TAS and therefore on the need to achieve sustained growth in agricultural productivity for sustained balanced growth. Another potential bottleneck, which would limit the supply response, would be limited capacity in rural industries, perhaps caused by inadequate infrastructure and human capital. A third possible bottleneck would be caused by limited supply response of the urban industrial sector, which might be the result, in an open economy, of foreign exchange shortages. The dynamic interaction can only occur in

the presence of good transport links between rural and urban areas, permitting the rapid and efficient transport of goods in each direction.

A virtuous circle of the type described does not need to be initiated in the agricultural sector. It could be initiated by an increase in industrial production, which would be associated with extra demand for agricultural products (for food and/or processing) and extra demand for mass-produced labor intensive commodities.

We have described how increases in income, patterns of demand, choice of product and technology may create a positive dynamic interaction between agriculture and industry, noting potential supply problems that could inhibit the process. It is also possible to sketch patterns of development that do not involve such a dynamic interaction. For example, an increase in agricultural production that is associated with a heavily skewed income distribution (e.g. one involving additional payment of rent to urban landlords and for industrial inputs but no increase in payment to labor) would raise expenditure on elite consumer goods, q'', but would have little effect on the demand for agricultural products, rural industrial products or mass-produced urban products, so that any further dynamic interaction would be extemely limited. Similarly, extra industrial output associated with capital-intensive production involving extra profits and some extra income for highly paid workers only would involve little extra demand for agriculture, rural consumer goods or urban mass produced goods. The demand for intermediate goods and investment goods may be analyzed along similar lines. In the agricultural sector, the nature of this demand is heavily influenced by the distribution of land and of credit (see the cited study by Kilby and Johnston).

This analysis has provided some significant indications for research on balanced growth: first, there is a need to investigate demand conditions associated with the virtuous pattern of balanced growth. This involves investigating income distribution, consumption patterns and associated technology choice. Secondly, there is a need to look at the supply conditions which may prevent such sustained interaction from occurring.

3.4 Linkages in an Open Economy

A closed economy requires balanced growth. In an open economy, international trade permits imbalances in internal development to be offset by patterns of trade. Economies at an early stage of development are unavoidably more closed in the relevant sense because, while they do export and import, their flexibility in using trade is much more limited. Large economies also more closely approximate the closed economy assumption than small ones. In the open economy, the agricultural sector's surplus, TAS, remains of critical importance for non-agricultural development. In the early stages of development, the industrial sector is generally a heavy net user of foreign exchange relying on imported capital goods and having little export potential. Hence the agricultural sector normally has to provide the foreign exchange (from the proceeds of export crops) as well as the food for workers in the non-agricultural sector. While export income may be supplemented by foreign savings, the latter rarely provides more than a modest portion of foreign exchange needs. As industrialization proceeds, the industrial sector may develop its own export capacity and so can begin to finance its own imports. But it generally remains

dependent on domestic agriculture for the bulk of its food requirements.

Export activities may also introduce a new sort of differentiation into the agricultural sector, with export crops sometimes requiring different input and organizational choices than the food crops. Export crops also frequently provide the basis of non-agricultural processing industries, thus introducing a further type of linkage, so that Q_m (industrial inputs into the agricultural sector) may have a counterpart, A_m (agricultural inputs in the industrial sector). This forward linkage is most prominent in exports, but also occurs with products for home consumption (e.g. textiles, paper) as well as, of course, the food processing industries.

The connections discussed earlier between income distribution, the pattern of consumption and the choice of techniques, also receive an added dimension once one introduces foreign trade. The more elitist products are likely to be more import-intensive (either being directly imported or at a second stage using imported parts), as well as more urban centered. Hence additional demand for industrial products following an increase in agricultural labor productivity will be likely to have a lower domestic content (urban and rural) the more unequally it is distributed, as well as having a higher urban and lower rural component.

In an open economy, the categories of non-agricultural activity noted earlier need to be supplemented by types of export activity. These are of three types:

Q_e: Goods sold to the external world

(v) labor-intensive exports, based on imported materials;

(vi) processing of primary products - agricultural and other;

(vii) other exports.

Each of these categories leads to an associated choice of technique; they also have varying linkages with the rest of the economy. The main immediate linkage induced by the development of labor-intensive exports is via the consumption (for agriculture and non-agriculture) of workers, but in the longer run other linkages develop. For example, export processing zones may gradually integrate backward and forward from their initial concentration on labor-intensive assembly only. The processing industries have an immediate direct linkage with supplying industries, and indirect linkages via the employment created. There is no particular presumption that processing industries need always be labor intensive; whether and in what conditions they are requires empirical investigation. But by their nature they involve more linkages than the 'other exports' category. The 'other exports' category tends to have lower linkages, as they are usually neither labor intensive nor use local products.

Strategies of Development

In the early stages of development, there may be limited strategy options. All countries have to rely on their agricultural (or mineral) sectors for foreign exchange to finance the early stages of import substituting industrialization. But later, a wider choice emerges. Countries have options with respect to trade, and options with respect to internal development. Moreover, there are connections between the two.

The trade options have been thoroughly explored in the literature; in particular, the distinction has been drawn between an industrial strategy of secondary import substitution, and one of emphasis on labor intensive exports. Secondary import substitution involves expansion of industrial production into capital and intermediate goods production and

into 'elite' consumption. Both tend to involve rather capital-intensive production methods. Because of the continued protection required, this option often means continued (or worsening) terms of trade for the agricultural sector. In contrast, a labor intensive export strategy may be associated with improved terms of trade for agriculture, and because of the greater employment, higher demand for agricultural products.

On the internal side, the major options consist in a balanced growth strategy, in which agricultural and non-agricultural growth is mutually supporting, and a more lopsided development in which industrialization becomes self-supporting, with limited links to the agricultural sector. The first option has been described earlier by the 'virtuous circle', where increased agricultural output is associated with patterns of consumption for non-agriculture involving labor intensive technologies in both urban and rural areas, thus leading to a mutually reinforcing growth in employment, incomes and consumption in both sectors. By contrast, industrialization involving expansion of capital intensive production of capital goods and elite consumption goods may occur with little interaction with the agricultural sector, and little regional dispersion of industry.

There are some natural links between the trade options and the internal options. The secondary import substitution strategy involves reduced links between industry and agriculture. It tends, in the long run, to lead to problems both internally and externally. Internally, it is generally associated with enclave development, concentrating the benefits of development rather narrowly, leading to problems of employment, maldistribution of income and of poverty. Externally, it tends to require heavy borrowing with subsequent debt problems. The

balanced growth strategy is designed to avoid the internal 'enclave' phenomenon by spreading participation in development more widely, geographically, and across classes. Balanced growth is liable to generate a more self-reliant form of development, with internal sources of savings and markets. However, to maximize its benefits, the strategy also requires international trade to make efficient use of the available oportunities. The emphasis on export of labor intensive commodities and of processed primary products is a natural adjunct to this strategy since the linkages involved in these types of exports will reinforce the internal balanced growth linkages.

In past analysis, overemphasis on international trade has tended to lead to a neglect of the internal dimensions of development strategy. Here we have identified a strategy of balanced growth in the context of an open economy, as permitting wide participation in the growth process, while making efficient use of the international trading system, and avoiding the external problems that have bogged down some recent modernization efforts. The major aim of the proposed research is to explore the conditions in which such balanced growth may best be achieved. But first we explore the spatial dimension in greater depth.

IV Spatial Dimensions of Transition Growth

4.1 The Spatial Perspective

The spatial dimension of development is of critical importance, if economic growth is to extend throughout the population. Yet this dimension is often neglected in focussing on economic aggregates. The issue of agricultural/non-agricultural linkages has an intrinsic spatial aspect because, by its nature, the agricultural sector is geographically dispersed. This section focusses on this spatial dimension, indicating the mutually positive effects that the agricultural and non-agricultural sectors may have on each other, where there is close proximity (physically) between the two activities.

Most less developed countries inherited a colonial system (political and/or economic) which involved certain spatial aspects. A colonial economic system includes two distinct types of economic region (see Diagram 2a), with an enclave region and a hinterland. The enclave region is formed by the linking of a hierarchy of urban centers (represented as squares) with the rails, roads, and/or rivers. As a rule, these enclaves represent those regions of the system which were initially most affluent because of their well developed irrigation and transport networks. Typically, e.g. with respect to Bangkok in Thailand and Manila in the Philippines, the major harbor, linking the system with that of the rest of the world, constitutes the urban center of the highest hierarchy. Two aspects of the colonial economic system need to be emphasized, namely, the external sensitivity of the enclave and the internal compartmentalization of growth. Both are relevant to the prospects for successful transition.

"Economic colonialism" describes a particular type of international economic relations, including international trade and international capital movements. A colonial economy is typically based on the export of a particular primary product (e.g. fibers or minerals) produced in the enclave, collected through the transport network, and exported through the major harbors to world markets. In return, the imports from the industrially advanced countries, (consisting of manufactured consumption goods (e.g. textiles) and producer goods (in the enclave), enter through the same harbors, and are distributed to the country's primary producers. At later stages of colonial development, foreign capital inflows may support the establishment of foreign owned factories (e.g. textile mills) and service establishments (e.g. wholesale and retail distribution, warehousing, banks, etc.).

The colonial economic system is an open economy which is extremely sensitive to any changes in the external terms of trade of the primary product. Throughout the colonial period, the fluctuation between "prosperity" and "depression" in the enclave was very much governed by the secular movement of prices in world markets. When the price trend was favorable, a capital inflow occurred to further the expansion and export of the primary product. Conversely, when such price trends were unfavorable, there were long periods of "colonial stagnation" accompanied by the cessation of net capital inflows or even the repatriation of capital and profits.

The major weakness of colonialism, as an economic system, can be traced to the fact that the economy is typically compartmentalized - i.e. divided into two spatially unintegrated parts creating a dichotomy between what we have called the enclave and the hinterland. The enclave

represents the relatively modern part in many senses: first of all, modern industries characterized by economies of scale, capital intensity, and the incorporation of modern science are located in the large urban centers. In contrast, small scale industries and specialized handicrafts are located in the smaller urban centers of the hinterland, characterized by traditional technologies in terms of labor-intensity and product characteristics. There exists a rather sharp contrast between the enclave and the traditional hinterland, from a technological perspective.

There is also a sharp contrast from a cultural or attitudinal point of view. While the enclave (especially in its urban centers) is characterized by a commercialized attitude, the traditional region is more conservative in outlook. In fact, the traditional desire for survival, security, comfort, and distinction prevailing in the hinterland gets only gradually converted , through long years of colonial penetration, into a more individualistic attitude, characterized by a desire for new goods and asset accumulation.

During the colonial epoch, the relatively modern enclave offers a sharp contrast to the traditional hinterland not only from a technological but also from an organizational perspective. The relatively greater community orientation of the traditional hinterland contrasts sharply with the relatively greater market orientation of the enclave. Such contrast can be maintained given the lack of substantial interaction between the two.

When a country with such a heritage begins to make the effort to reach modern growth (as occurred widely after 1950), action, of economists as well as government officials, usually concentrates

overwhelmingly on the enclave. It is here that colonial-type profits continue to be made. This situation also customarily leads to an overwhelming concern with stabilization of the prices of primary products as a direct response to the problem of the external sensitivity of the colonial economic system. In more recent years, the literature on the development of the open economy, encompassing issues like imports, exports, foreign aid, commercial capital inflows etc., has again centered on the more modern and more affluent, enclave portion of the economy, while issues related to the development of the traditional hinterland that may contain a very large fraction of the total population continue to be largely neglected - just as they were in the "compartmentalized" days of the colonial era. In other words, while in many cases the enclave is gradually changing its character from being largely raw material-oriented to largely industry-oriented, the relative situation of the hinterland has not been profoundly affected.

The notion of a linkages approach to modernization takes on a special spatial connotation in this context, i.e. the way to mobilize the traditional hinterland and involve it in development is to break the compartmentalization of colonialism, through economic interaction with the relatively advanced enclave. The spatial spread of the forces of modernization, from both the technological and organizational standpoints in fact amounts to such an integration or linkage between the two regions through which modern inputs, attitudes and organizational methods can be gradually transmitted from the "modern" sector of the enclave to the traditional hinterland.

It should now be noted that a third major contributing factor to understanding agricultural stagnation is traceable to the spatially

relatively more dispersed pattern of location of the rural population (see Diagram 2b), which makes it more difficult for members of the rural population to have contact with each other and/or with the urban population. The transformation of attitude and the acquisition of new knowledge becomes more difficult when both contacts and communication with other people are infrequent. Agricultural modernization is especially difficult not only because the farmers are alienated by distance from the modernization core, but also because of their less frequent contacts with each other.

The locational disadvantages of farmers cannot be easily overcome because of other pervasive economic forces that determine the spatially dispersed pattern of their location in the first place. Several such factors may be mentioned. First, agricultural production is characterized by joint inputs between population and land which forces a certain spatial spread. Second, in order to minimize the daily cost and time of transport, farmers usually live in villages or even separately, close to the fields they cultivate. Finally, since agricultural production is usually characterized by constant returns to scale, there exists no strong economic reason from the agricultural production side for higher population densities. These three factors in agricultural production contrast very sharply with non-agricultural production which is characterized by (i) the more likely existence of economies of scale and (ii) the existence of conspicuous external economies tending to a spatially more centralized pattern of non-agricultural production at the urban centers.

The fact that the rural population is spatially dispersed makes it more difficult to modernize agricultural production via a "centrally

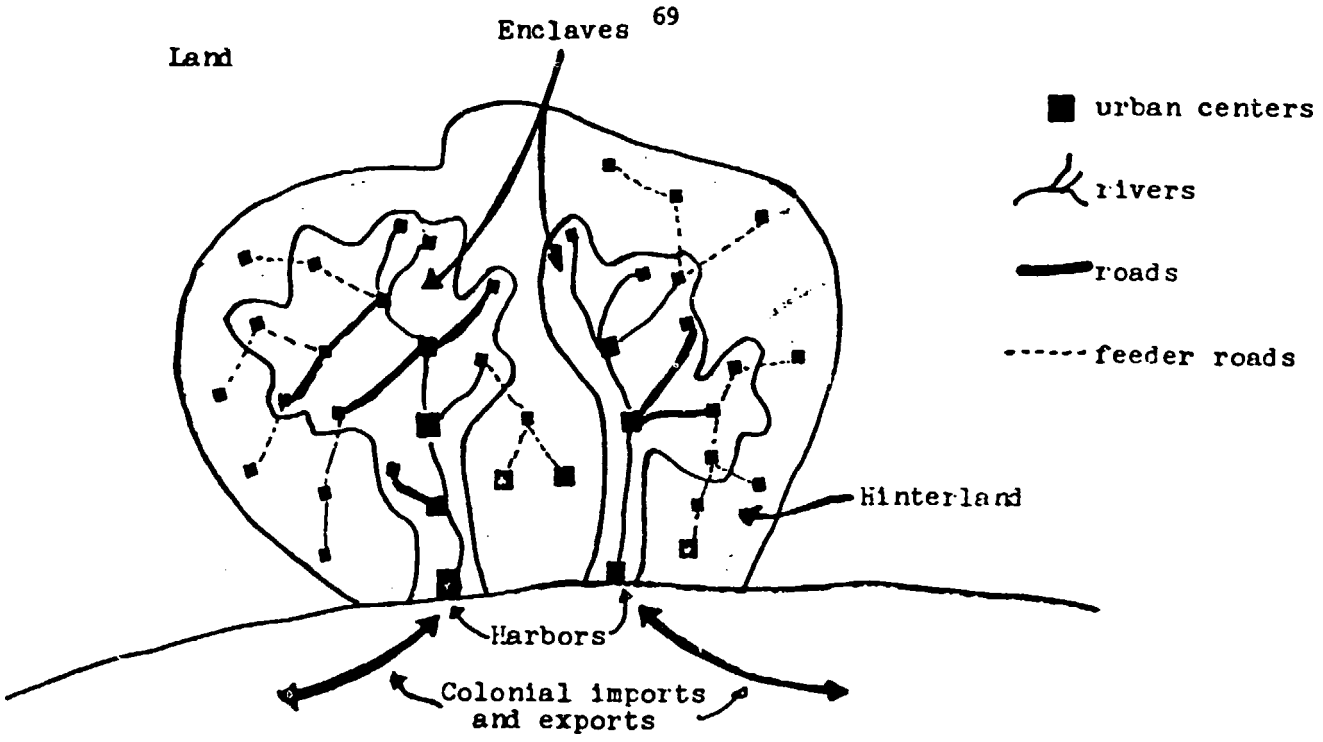


Diagram 2a Spatial Perspective of Economic Colonialism

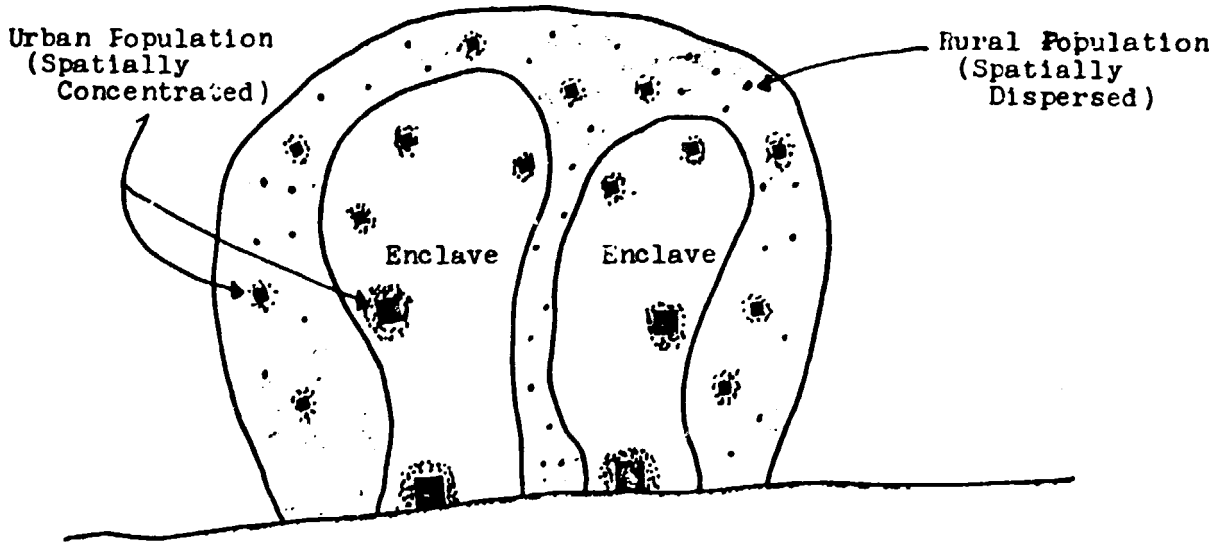


Diagram 2b Location of Population in a Dualistic Economy

coordinated command system" such as the system experimented with in socialist societies. It is basically more difficult to gather 1,000 farmers in one place for a combination of political indoctrination and economic instruction than to gather 5,000 urban industrial workers. It is also more difficult to monitor peasants and to determine individual contributions to productive effort according to which an incentive system could be centrally enforced. This is one of the basic reasons that collectivist organizational systems have encountered problems in the performance of their agricultural sectors and frequently been forced to experiment with different forms of incentives and organizations.

4.2 The Dualistic Standard Market and the Local Rural Community

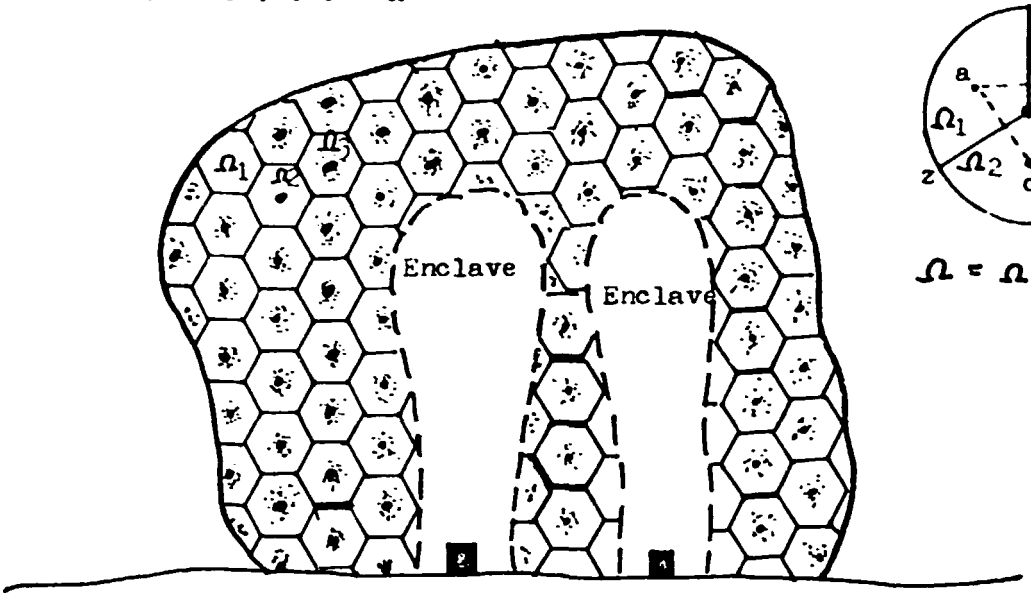
The difficulties associated with the modernization of the agricultural sector are strongly related to the transformation of the traditional attitude and outlook of farmers. Some of the motivations of human beings, e.g. desire for survival, security, etc., may be quite individualistic in the sense that even Robinson Crusoe, living all alone, is subject to them. Other motivations — e.g. the desire for distinction, power, and domination — are clearly more social in nature. It is thus safe to say that, in the contemporary world, the satisfaction of the totality of human desires is a social phenomenon analyzable only when the farmers are viewed within a group context.

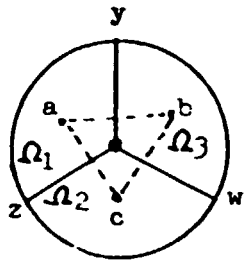
In the analysis which follows, a dual standard market is used to define such a rural community. In diagram 2c, the urban and rural populations of diagram 2b are partitioned into a number of localized "market areas" $(\Pi_1, \Pi_2, \ldots \Pi_n)$ each of which contains a single urban center (with its urban population) and its share of the rural

population.

Diagram 2d presents a microscopic view (i.e. an intra-standard market view) of a typical standard market area. At the center of $_i$ we find the urban center with its spatially concentrated pattern of urban population and its share of the spatially dispersed rural population. The urban population engages in non-agricultural production (e.g. rural handicrafts, food processing, Z goods, retail trade), while this urban core also serves as the center of educational and spiritual life (schools, recreation, religion) as well as political administration (justice, police, tax collection, and government services). The urban center is the focal point for contact among all the economic agents living within the standard market area, including the more dispersed farmers. Given the relatively primitive means of transport and communication, the only way farmers can communicate with members other than their own immediate family and neighbors, is by their temporary physical presence in these urban centers. To make such personal contacts, it is necessary for the farmers to make occasional visits to the center while engaging in both economic and non-economic activities.

We are now in a position to add a spatial dimension to the account of intersectoral linkages of Section III: while agricultural production is carried out by the spatially dispersed farmers, non-agricultural activities are partly carried out in the household and partly in urban centers at different levels of the hierarchy. Dualistic exchange, i.e. the exchange of agricultural for non-agricultural goods, takes place; farmers carry their produce for sale to the market place at the urban centers and buy most of their non-agricultural requirements in the same marketing centers. While carrying out these economic functions, the





$\Omega = \Omega_1 \cup \Omega_2 \cup \Omega_3$

Diagram 2c Standard Market Areas

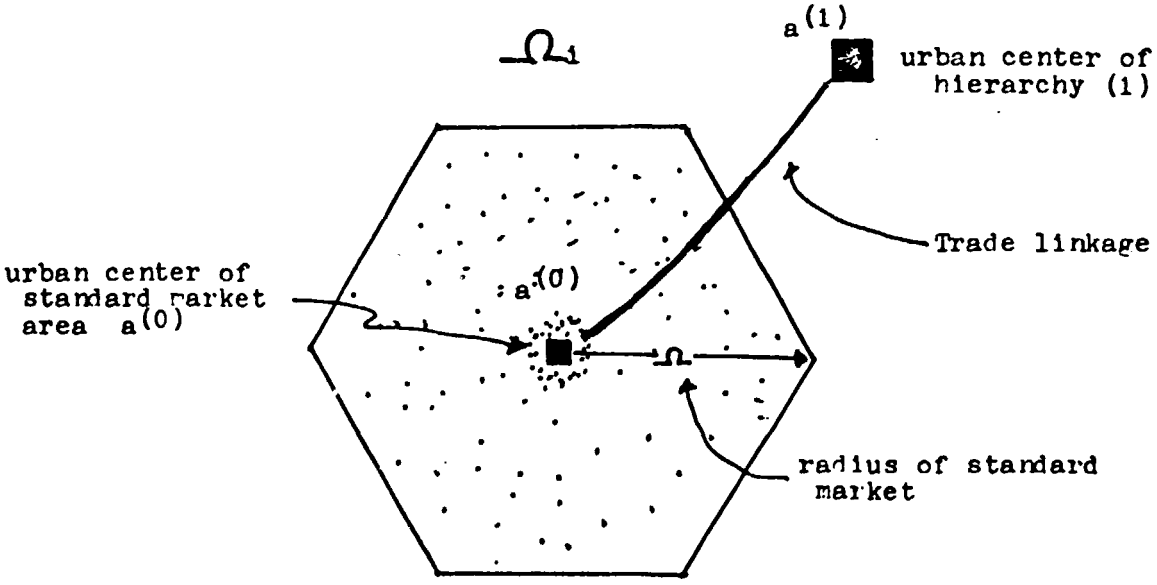


Diagram 2d Standard Market as a Dualistic Community

farmers also have other contacts which permit them to acquire modern products and ideas: they learn about incentive goods like bicycles, sewing machines, and factory printed cloth, as well as about modern producer goods such as chemical fertilizers, agricultural machinery and new seeds. While formal education may help, it is more through these informal contacts that farmers learn about the world of the enclave and beyond, i.e. mainly by contacts with the urban population within the local marketing centers.

The fact that an agrarian dualistic economy may be partitioned into a system of parallel localized standard market areas is basically due to the need to economize on transport costs. The principle of the delineation of the boundaries of the standard market area is demonstrated in the insert of diagram 2c. Suppose there are three urban centers (indicated by "a", "b", and "c"). Let the triangle abc be constructed. The straight lines ab, bc, and ac of the triangle may be interpreted as the roads linking the three urban centers. Let the straight lines xy, xw, and xz be the perpendicular bisectors of the sides of the triangle abc that meet at a common point x. The lines xy, xw, and xz then constitute the boundary of the three standard market areas Π_1, Π_2, Π_3 (each containing its own urban center "a", "b", or "c"). If all spatially dispersed farmers are to minimize their transportation time and cost in carrying out their dualistic exchanges, they will necessarily trade and affiliate with the urban center of the area to which they belong.

The existence of these standard markets arises from the need to minimize transport time and costs. In traditional societies, the energy consumed by such transport requirements as between "field" and "town" is

of substantial importance and may well exceed the farmer's costs in plowing or harvesting.

Where means of transport and communications are linked, the main way people communicate with each other is through personal contact. This sets a limit on the size of the standard market area in an agrarian community. The maximum value of the radius of the standard market is such that it allows the least advantageously located farmer to make a round trip in a reasonable period of time (e.g. less than half a day) leaving some time for him to carry out the dualistic exchange in the urban centers.

A given region may be partitioned either into a large number of small market areas (ii) or a small number of large market areas (i) (see Diagrams 2c (i) and (ii)). In addition to transport cost, two other factors help determine the optimal size of the typical standard market, namely, population density and the extent of scale economies in non-agricultural production.

The size of the urban population at each urban center is roughly inversely related to the number of standard markets. Thus, if urban industries are characterized by greater economies of scale and externalities, the standard market areas would tend to be larger.

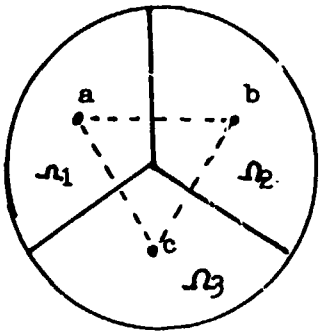
The optimum size of the standard market is thus bounded from above and below by certain economic considerations. On the one hand, its size cannot be too large, in order to economize on the transport costs associated with dualistic exchange. On the other hand, its size cannot be too small, in order to take advantage of economies of scale which may exist in the production of goods being demanded at current levels of income. The optimum size of the standard market depends on the outcome

of a balancing between these factors.

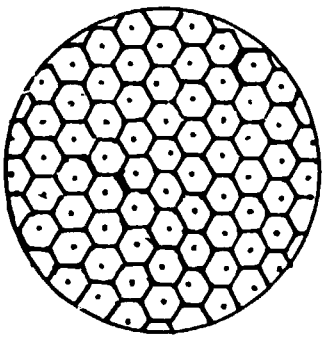
As population density increases, the individual standard market area size also tends to shrink, ceteris paribus, and the number of markets to increase (see Sections (iii) and (iv) of Diagram 2e). This is due to the fact that with increasing population density, the efficiency of large scale production can be realized with a smaller market area (i.e. case iv), so that the economy of transport cost leads to shrinkage of the standard market area.

A smaller standard market constitutes a favorable condition for modernization of agriculture, other things being equal. This is due to the fact that a smaller market area involves a much more close-knit community in the sense that it is easier and cheaper for farmers, especially those located near the market boundary, to engage in more frequent contact with the urban centers.

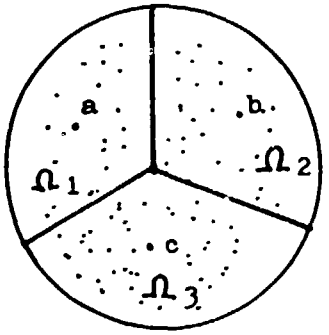
In much current discussion about population pressure, a large population with a limited landspace and a high population density is often regarded as undesirable. This is because a high population density also, of course, involves a higher ratio of labor to land, which is likely, ceteris paribus, to mean lower agricultural labor productivity, but higher agricultural land productivity. But, from the viewpoint of the modernization of spatially dispersed farmers, we have come to the unorthodox conclusion that a larger population may, ceteris paribus, be helpful. For example, if we imagine the case of a very thinly populated region (e.g. one or two persons per square mile) as in Tibet, the size of the standard market would have to be reckoned in terms of hundreds of square miles in which a farmer will have to travel a month before he can reach the "urban center". In that case, the



(i)

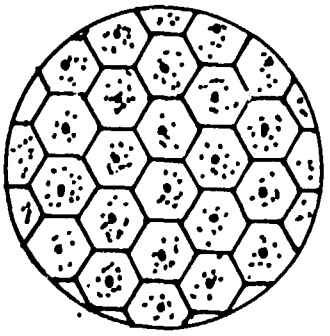


(ii)

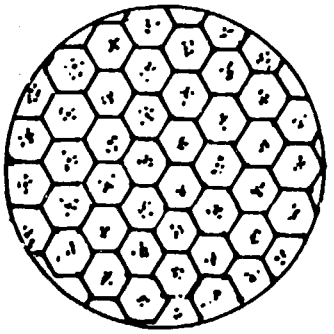


Ω_1 Ω_2 Ω_3

(iii)



(iv)



Ω_1 Ω_2 Ω_3 Ω_4 Ω_5 Ω_6

(v)

Diagram 2e Size of the Standard Market

thinness of the population is a barrier to human communication, rendering human contact minimal.

As the population density increases and farmers make contact with more people these contacts become less personal and more contractual. In a traditional rural community, everyone knows everyone else — thus a cloth seller or a salt merchant is a friend of the farmer — contrasting sharply with the commercialized relations in enclave transactions. In a large urban center, the farmer tends to judge the large number of contacts impersonally, i.e. from the viewpoint of convenience and efficiency. A slow process of conversion of this type produces farmers who approach "economic men", maximizing individual or household welfare.

4.3 Implications for Agricultural Modernization

A high population density is not by itself sufficient for the modernization of agriculture. For example, Taiwan, a region with one of the highest population densities in the whole world, has constituted an unusual success case of agricultural modernization. In contrast, in Java, with an even higher population density, agricultural modernization has been less satisfactory. In the case of Taiwan, it is the density of population plus the high volume of dualistic exchange (i.e. trade between farmers and urban producers) that has contributed to the transformation of Taiwan's farmers into modern economic agents along with the help of favorable "input" and "organizational" elements.

The extent of dualistic trade depends in part on the prosperity of the agricultural sector since high agricultural productivity is conducive to the development of non-agricultural activities. For when agricultural labor productivity is high, the percentage of non-agricultural labor force will be higher — a familiar phenomenon explainable by Engel's Law. A higher agricultural productivity (as in the case of Taiwan) leads to a higher percentage of urban population within a standard market area as well as a larger volume of dualistic exchange on a per capita basis. The shift of the population structure (with increasing urbanization of the population), causes the area of the standard market to shrink further, because of the change in transport costs in relation to scale economies. In the case of Taiwan, higher agricultural labor productivity brought about a spatially dispersed pattern of industrial location, and an increased linkage of the rural and urban population because of the high volume of tradeables produced — i.e. the TAS.

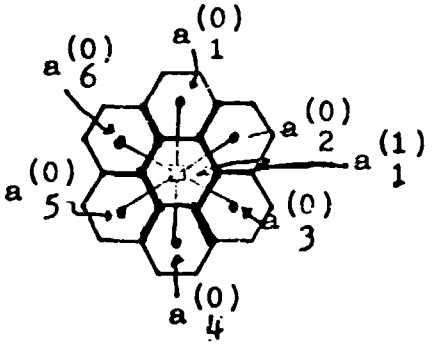
Thus agricultural stagnation in the hinterland can be explained in the context of a vicious circle paradigm. For a traditional society, the fact that agricultural productivity is relatively low leads to a relatively large market area and a relatively low volume of dualistic exchange; this, in turn, reenforces agricultural stagnation because it is not conducive to rural-urban interaction. As in all vicious circle arguments, the pessimism always also implies the possibility of optimism, namely, once agricultural productivity increases, it will lead to more rural-urban interaction and linkages that will further the expansion of both industrial and agricultural productivity through the promotion of rural/urban interaction. At the same time, all vicious circle arguments suggest that it is not always easy to say for sure what is the best way to "shake things loose" because everything is related in a dead-locked as well as in a dynamic system.

While we have portrayed the standard market as a locally self-sufficient economic unit as a first approximation, this is, of course, not true. The higher the level of agricultural productivity (i.e. the more affluent the rural community), the more likely that it will lose its autarkic status. The urban center of the standard market area is, in turn, linked to towns of higher hierarchy.

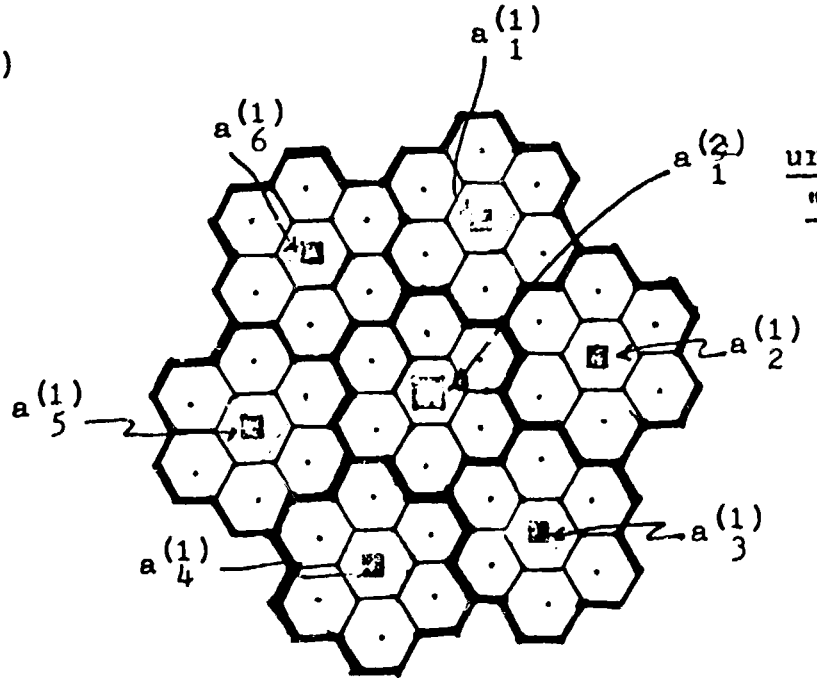
A comprehensive perspective of the full hierarchy of urban centers reaching into the enclave is indicated in diagram 2f (1) with the six urban centers of the standard markets $a_1^{(0)}$, $a_2^{(0)}$, ...$a_6^{(0)}$ surrounding the (shaded) standard market with its urban center $a_1^{(1)}$. The existence of this higher hierarchy urban center $a_1^{(1)}$ has economic, political, and cultural significance. From the economic standpoint, $a_1^{(1)}$ came into existence because it contains

(i)

urban center of hierarchy



(ii)



urban center of "order 2"

Diagram 2f Hierarchy of Urban Centers

industrial activities characterized by economies of large scale production. It exports these manufactured products along the trade routes to supply the other standard markets through their urban centers $a_i^{(o)}$ (i=1, 2, ...6). Thus the dispersed farmers in each standard market, while trading directly via their own urban centers, also trade with the urban center $a_1^{(1)}$ for those products that enjoy more conspicuous economies of scale and external economies. The urban centers of the $a^{(1)}$ type thus serve a much larger market area encompassing several standard market areas.

The notion of a hierarchy of market centers can be carried further to urban centers of an even higher hierarchy: In diagram 2f (ii), for instance, six of the "snow flakes" of diagram 2f (i) are shown to surround a large snowflake in the middle, with an urban center $a_1^{(2)}$ which is of an even higher hierarchy (2). Its industrial activities are subject to even more pronounced scale economies and serve an even larger number of standard market areas. The fact that local farmers can trade with larger urban centers (e.g. $a_1^{(2)}$) located far away is due to the fact that the economies of scale are sufficient to compensate for the larger transport costs.

Linkage between the agricultural and non-agricultural sectors have a spatial dimension traceable to scale economies of non-agricultural production and transport costs. The gradual conversion of traditional farmers into modern economic agents, aware of the potential of new agricultural technology, experiencing wider consumption horizons, and aspiring to accumulate assets, can be accomplished only through the strengthening of linkages with the urban centers. Similarly, the small-scale rural industrial entrepreneur will become aware of his

opportunities via linkages to urban industry on the one hand, and cultivating farmers on the other. A small-town industrial producer or a peasant in the hinterland may only be aware of the possibility of exchange within the local towns of a low hierarchy; but a modern farmer and modern industrial entrepreneur is likely to become increasingly aware of the possibilities of carrying out all kinds of exchanges with far away places — including those in the enclave and even in world markets.

4.4 Modernization of the Ex-Colony

Returning to the spatial perspective of diagram 2a, we saw that the growth compartmentalization of colonialism permitted only the modernization of the enclave which usually encompasses only a small portion of the rural population. When the country is small, the task of transition to modern economic growth is easier because a small country has the option of development through foreign trade. Given a negligible hinterland, farmers can rely on exchange with far away urban centers. The early success of agricultural modernization of Taiwan is partly a story of this type. Indeed, her early success with an external orientation (after 1962) was primarily located in the export of asparagus, mushrooms, and pineapples, i.e. the farmers learned to take full advantage of international trade. Through learning by doing, Taiwan's farmers were no less "entrepreneurial" than the industrial exporters of Hongkong. It was the conversion of Taiwan's farmers into commercialized types that was a large part of the secret of her successful development performance.

In the case of a large country with a huge hinterland, development

exclusively through international trade is undoubtedly not a practical option. Here it is necessary to form linkages between spatially dispersed farmers and urban centers, mostly within the domestic economy. The recent experience of India and Mainland China has shown that it is indeed this linkage through dualistic exchange between agricultural and non-agricultural activities which is crucial to a system's escape from agrarian stagnation.

The analysis suggests the importance of proximity between farmers and urban centers for agricultural and industrial modernization. This concept of proximity has two dimensions: first, it is a function of the average distance between the individual farmer and the relevant urban industrial center; secondly, of the available means and costs of transport.

The degree of such proximity has a number of effects on farmers' and rural industrialists' activities:

i) by increased contact with modern activities and consumer goods it may change their attitudes towards a more capitalist orientation;

ii) the more immediate proximity of the various services (e.g. technical advice, credit, fertilizer, seed supply, raw materials) may lead to greater use of modern inputs;

iii) greater opportunities arise for farm family members to participate in non-agricultural activities for part of the year;

iv) markets for both agricultural and non-agricultural products will be widened;

v) the price of all consumer goods (allowing for transport costs) is likely to be reduced ceteris paribus and their availability increased.

These effects are likely to vary according to the stage of development and the size of the relevant urban center. For example, at the early stages of development, the effect on farmer attitudes through contacts may be of paramount importance. However, in many countries it seems that most farmers already have a capitalist orientation to incomes and accumulation similar to dispersed non-agriculturists and proximity may be more important in terms of its effects on supplies and markets.

Similarly, these proximity effects would tend to be greater, the bigger the size of the urban center. Urban centers of higher hierarchies offer a wider range of services and consumer goods with greater contact with the enclave and the rest of the world. Greater proximity to these (also a function of distance and transport) is also likely to be a positive factor in agricultural modernization, especially at a later stage of development.

Assuming proximity does contribute to balanced growth, in the ways enumerated above, certain policy implications follow: policies which increase the degree of proximity would contribute to raising agricultural and non-agricultural productivity. Such policies would include attitudes towards industrial location, i.e. decentralized industrialization would ceteris paribus have positive effects on agricultural modernization and back again on further industrialization. Moreover, policies relating to the improvement of transport and other infrastructural links between the agricultural and non-agricultural populations at various levels of urban hierarchy would remove a bottleneck to various kinds of linkage playing themselves out, with a dynamic mutual interaction between agriculture and non-agriculture as a consequence. This is what we mean by the linkage effect.

Our basic aim is to explore the conditions in which such a dynamic interaction occurs in order to identify those feasible government policies which would help promote the process by removing obstacles and strengthening linkages. To realize this objective we need to contrast situations where this dynamic interaction has developed and where it has not. In order to maintain as many ceteris paribus conditions as possible, it is desirable to select different areas within the same country, characterized by differential performance on balanced growth. Moreover, it is necessary to make comparisons across countries of different typological characteristics and stages of development.