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#4

MARKET PRICE RELATIONSHIPS

IN

REGIONAL PLANNING FOR RURAL DEVELOPMENT

Working Group on the Rural Poor
United States Agency for International Development
Washington, D.C.

D R A F T

ABSTRACT

In selecting market development strategies it is important that explicit consideration be given to readily identifiable form, time and space dimensions of market price. Strategies dealing with the space dimension include choices of whether highway X or Y should be built and, if both are to be built, which should be built first. The investment selected will depend on how product prices or costs can be expected to change upon completion of the project. Strategies to modify product form may include decisions to build a processing plant or to construct assembly market facilities in order to enhance the net price received by producers and improve employment opportunities in the area. The time structure of market prices may be modified by the construction of new storage facilities or by the provision of drying equipment and insect protection services. The payoff to any market development strategy can be measured in terms of the prospective change in the form-time-space configuration of market prices and the resulting changes in product flows from producer to consumer. In addition, the impact of such improvements upon employment and income potentials in the affected region can be traced.

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Using Market Price Relationships in Planning for Rural Development

INTRODUCTION

An Overview

Development planning with an explicit regional focus is needed in order to meet more effectively the needs of the small farmer and the "poorest majority" of the population in developing countries. This regional emphasis on project planning and implementation will provide new insights into the interdependencies between urban centers and rural areas where a large proportion of the target population resides.

The Dimensions of Market Prices

In developing economies where agriculture dominates many other activities the agricultural marketing sector is one in which the expectation of high-speed modernization is often the least realistic. Unfortunately, opportunities for a forward leap are far less common than are the changes that may lead one or two steps forward. Costly storage facilities, underutilized processing plants and overgrown market facilities litter the landscape in country after country as a result of inadequate evaluation of their potential. The desire for high visibility often overtakes the slow and difficult search that often attends less spectacular but more economically viable local village or regional market projects.

The role of market price as a critical force influencing the economic viability of rural development projects is the focus of this paper. In contrast to the usual treatment of market price as a "spaceless", i.e., national phenomenon, this paper emphasizes the space, form and time dimensions of market price that are of central importance to development specialists. These three dimensions can be summarized vary briefly:

1. The spatial dimension of price which is influenced by production sites, location of consuming centers and costs of transfer from one location to another;

2. The prices of alternative product forms in which a raw product may be sold and the impact of processing costs on these finished product prices; and

3. Price relationships over time within a given production and marketing cycle which reflect the costs of storage from one point in time to later periods.

Responses to Market Prices

More attention must be given to the role of product markets in the economic development process. There can be no doubt that improvements in the marketing of agricultural products are possible in many developing areas of the world. The cause for concern about market inefficiencies is suggested by a basic premise on which this paper rests. The premise has been clearly stated by Earl Heady (1966, p. 3) when he writes that "At every point over the world where sufficient data are available it has been found that farmers respond to changing farm product prices and farm input prices." Obviously, farm product prices are transmitted by and reflect the efficiency of the marketing system.

Business firms engaged in the assembly, processing, storing and distribution of agricultural products also play a central role in determining the rate of development of the agricultural sector of LDC's. Furthermore, the success of quasi-governmental or publicly operated entities engaged in agribusiness activities depends to a large extent on an understanding of the same principles that lie back of comparable decisions by private business firms.

While technological development and innovation are generally regarded as having a high payoff in LDC's, clearly the rates of adoption and the levels of payoff depend on economic circumstances in the individual country setting and are therefore quite "location specific," reflecting unique space, form and time price relationships.

Agricultural marketing systems then, through the transmission of relative product prices, play an important role in farmers' response. But what kinds of changes in product markets are called for in order to stimulate the desired output of farm products and to entice into the market economy many producers who are now outside commercial agriculture -- and indeed outside the money economy -- in many nations of the world? Development models must be formulated in such a way as to deal with the problem of selecting the best among alternative strategies, or at least in identifying profitable opportunities. The choice of a strategy depends upon the payoff from alternative courses of action. These alternatives often must be evaluated on the basis of incomplete market information.

Typical Market Development Questions

The discussion of development strategies can be made somewhat more concrete by considering a few specific questions dealing with

agricultural marketing in Peru. A new agricultural area in the Huallaga Valley is in process of being opened for settlement. It is located on the eastern edge of the Sierra region and will be accessible upon completion of a highway across the Andes close to the Ecuadorian border. In time the valley transport network will be tied into the central highway to the Amazon River from Lima. What type of marketing facilities should be planned for this area? Clearly this depends upon the products that will be produced in the Valley. But this mix will depend in turn upon what products will be most profitable, given the likely cost of inputs and prices received for farm products. Some procedure is needed to forecast these prices and costs before the region is fully settled. Since surveys of existing markets cannot be made in such situations, a theoretical model must be used that will make it possible to relate prices in existing market places on the coast to future assembly markets in the Huallaga Valley.

Would a processing plant built in Tarma improve the returns to orange production in the area? Again, since local market prices are not available a model that will project processed orange product prices must be relied upon in order to compare the potential profitability of a processing plant operating at various output levels with recent experience gained in the sale of fresh oranges in the Lima area.

Would new potato storage facilities in the Sierra increase incomes of farmers? In this situation it is necessary to compare recent seasonal changes in potato prices with those that might be expected if various proportions of the crop were to be placed in storage. Consideration must be given to availability of competing supplies from other parts

of the country as well as to the costs of holding potatoes for varying lengths of time. Each such alternative can be thought of as a different market strategy.

The "Perfect Market" Model

Among the models which are available for evaluating alternative strategies for product market development, we find that the perfect market in space, time and form is a useful framework. Using this model it is possible to study the existing situation and to plan specific market development proposals.

The perfect market model can be described briefly as follows. Prices in different geographic areas of a country will differ by not more than the cost of transfer from one point to another. Within a given market area, prices will differ exactly by transfer cost from point of production to point of consumption. Where this condition does not hold, multiple markets are said to exist. Similarly, prices at one point in time will not exceed prices in a previous point in time by more than the cost of storage. Failure of this condition to hold is evidence of distinct markets in the time dimension. Finally, the price of a product will differ from the price of another product derived from the same raw product by no more than the cost of processing.

We thus have available a model which describes price relationships among geographically separated points in space, among different points in time, and among alternative forms of a common raw product. Is this model an adequate representation of the product markets observed in developing areas of the world? It is possible that the decision-making process of producers and marketers may not be price oriented. It is clear,

for example, that a self-sufficient agriculture is substantially different from an agriculture in which farm products are produced primarily for exchange. Similarly, in a handicraft industry artisan goods may be sold on order instead of being mass produced for the general purchaser. In these two situations it is quite possible that price would play a minor role in short-run decisions.

Another factor that might affect the role of price is the pattern of ownership of production facilities. We may find, for example, that absentee ownership or communal ownership will result in decision-making procedures different from those found where owner-operators predominate. It is also possible that public policy builds into the market price system certain types of divergencies from the model without allowing for regional variations in storage costs or transport costs to urban or overseas markets. For example, prices paid to producers of Peruvian rice may be fixed at a uniform level throughout the country as a result of public price policy decisions. Finally, we may find that discontinuities exist in market price relationships. It will be necessary to investiage the sources of market imperfections in order to make recommendations as to how they might be reduced. The perfect market model is a way of identifying these imperfections.

THE SPATIAL DIMENSION OF MARKET PRICE

The Importance of Regional Specialization

Regional specialization in the production and marketing of agricultural products can contribute to the improvement of economic wellbeing in many developing countries. The United States experience illustrates how this may come about. Economic activity in Twentieth Century America is characterized by a very high degree of regional specialization. With regional specialization comes extensive trade among regions. Widespread movement of goods and services from one region to another is possible only in the absence of barriers to trade and with well-developed transportation and communication networks.

The movement of goods from one region to another takes place in response to price differences which make such movement profitable. For many commodities, and in particular for most agricultural products, the United States can be viewed as one large market with prices in any one region closely tied to those which exist at the same point in time in other regions of the country.

Regional specialization in farming reflects the differences in adaptability of different regions to the production of agricultural commodities. Dairy production is concentrated in the Lake States, corn-hog farming in the Midwest, cotton in the South, tobacco and peanuts in the Southeast, wheat and cattle in the Great Plains. Production in a region is influenced by production costs, including potential income from other uses of the resources in the region, and by transfer costs.

The quality of transportation services which are available plays a critical role both in the assembly of raw product in farming areas

and in the distribution of processed products from producing area to consumer markets. With highly developed transportation facilities, it is not necessary to have food production closely synchronized with population centers. This has made possible tremendous economies in production and dramatic reductions in the relative cost of food purchased by U. S. consumers.

Improved highways, air communications, and rail networks are two-way streets, so to speak, and do not guarantee more agricultural activity in every region. In some regions, opportunities for expansion of production will open up. In other regions the greater competition from distant areas can result in a contraction and disapperance of particular lines of production. For example, interstate highways across the Appalachian Mountains would provide opportunities for products from the Midwest to enter southeastern markets as well as providing new market opportunities for goods produced in the Southeast.

With regional specialization in the production of agricultural commodities has come specialization in marketing. In fact, regional specialization reflects both the adaptability of regions in production and the opportunities for economical production of marketing services. Opportunities to ship from low-cost areas to higher priced markets benefit producers in a low-cost area and consumers who are now able to buy at a lower price. On the other hand, high-cost producing areas tend to be placed at a disadvantage with the new trading pattern, and shifts of resources out of the less competitive line of economic activity can cause temporary hardship.

Free trade among regions has contributed greatly to the high level of living enjoyed in the USA. Greater coordination and integration of regional economies in the LDC's can be expected to have similar consequences.

A Two-Region Trade Example

The broad outline of the spatial dimension of market price has been sketched briefly. We turn now to a more careful analysis of how prices at different geographic locations are related through transfer costs. To do this we will use a simple diagram with a supply curve and a demand curve for each of two "regions" or spatially separated points at which sales and purchases of a commodity take place. A slight complication is introduced when we draw these two parts of the diagram in a "back-to-back" fashion (Figure 1).

The information needed in this model consists of the following:

1. A supply curve for each region.
2. A demand curve for each region.
3. The cost of transfer from Region B to Region A.

In the absence of trade between the two regions, the price at which the quantity supplied in Region A would equal the quantity demanded in Region A (as shown by the intersection of the two curves in the left hand side of Figure 1) is substantially higher than the price that would exist in Region B. Region B would find it profitable to sell part of its output to buyers in Region A. Note that we must account for the cost of shipping each unit to Region B. This has been done by lowering the left side of the diagram by an amount equal to this cost of transfer (which includes not only the direct cost of "transportation" but also any associated costs of loading, unloading and other costs of moving the product from B to A).

The perfect market would result in the equilibrium price, P_e, that exactly equalizes the differences between the quantities supplied and demanded in the two regions.

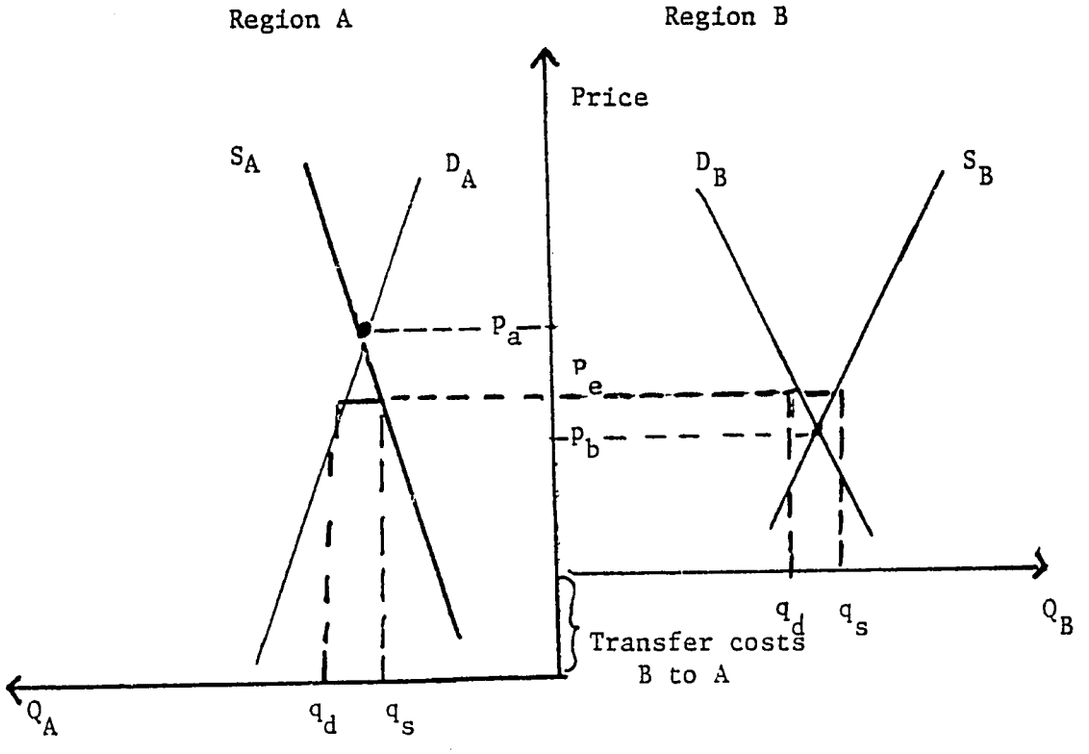

Figure 1. Diagram illustrating market price for a commodity traded from Region B to Region A.

What are the effects of trade between the two regions? The price in Region B is higher than it would have been in the absence of trade, resulting in larger quantities supplied but smaller quantities demanded. In Region A, the importing region, price is lower than it would have been in the absence of trade, the quantity supplied is lower but the quantity demanded is higher. Transportation resources are required to move the quantity of product shipped from B to A.

Consider now a hierarchy of communities such as a capital city, a regional city, district town, a farming locality town in a farming area. Region A might represent the city or district center and Region B the local village. Village prices would be expected to be lower than the district center price, the difference representing transfer costs. How would a road improvement project change this example? The impact of the new road would be represented by a new, lower cost of transfer that would tend to have the following effects:

1. Raise the price in the village, encouraging greater production and reducing the quantity consumed locally.

2. Lower the price at the district center, increasing the quantity demanded.

3. Increase the volume shipped from village to district center, requiring more labor, transport and associated services and thus increasing employment in the service industries of the area. Larger, lower cost-per-ton-mile vehicles might also be introduced.

Such a model provides a possible approach to evaluating the potential benefits from alternative road projects. Where would road improvements have the greatest impact in terms of improved farm prices, encouraging greater output and contributing to lower consumer prices? Clearly, the answer depends on the responsiveness of both producers and consumers to price changes and on the size of the reduction in transfer cost brought about by the several projects under consideration.

An Eight-Region Example: Peruvian Rice Trade

A study of regional rice supply and demand relations in Peru during the mid-60's will illustrate how the perfect market model might be used to measure the importance of location and the relation between transfer costs and regional price behavior. The approximate location of rice surpluses and deficits is shown in Table 1. Marketable surpluses are concentrated on the north coast, the south coast and in the high jungle while the rest of the country is largely deficit. In addition to the domestic supply of 125,470 metric tons, imports of nearly 50,000 tons were purchased from abroad. Assuming that all imported rice was consumed in Lima, the domestic supply would be allocated as shown in Figure 2, given the transfer costs shown in Table 2. The transportation problem, a variant of linear programming is used for this purpose.

Rice prices in each area can be expressed as premiumms or discounts relative to the Lima price. In the North Coast the price would be that in Lima less 171 soles per ton or S/.-171. In the High Jungle the price would be S/.-458 and in the Low Jungle S/.-94. Although the South Coast is slightly surplus, the price in Camaná is S/.229 higher than that in Lima. In the deficit areas prices are S/.-143 in the North Sierra, S/.372 in the Central Sierra, and S/.642 in the South Sierra. Under perfect market conditions prices would thus rise sharply from north to south reflecting greater distances from major surplus areas.

In this example we have shown how transfer costs may be used to identify optimum shipping patterns for rice. But we can go further than identifying product flows to show the price relationships that would be expected to exist, given that prices in consuming and producing areas

Table 1. Approximate location of excess rice supply and demand, 1963-64[a]

Economic area	Supply	Demand	Net
		(metric tons)	
1. North coast	89,900	14,656	75,244
2. Central coast	-	72,087[b]	-72,087
3. South coast	12,820	12,482	338
4. North Sierra	-	3,476	- 3,476
5. Central sierra	-	13,865	13,865
6. South sierra	-	6,099	- 6,099
7. High jungle	18,400	40	18,360
8. Low jungle	4,350	2,765	1,585
Total	125,470	125,470	0

[a]Based on Mathia and Coffey (1965, p. 14).

[b]Does not include imports of 49,178 metric tons.

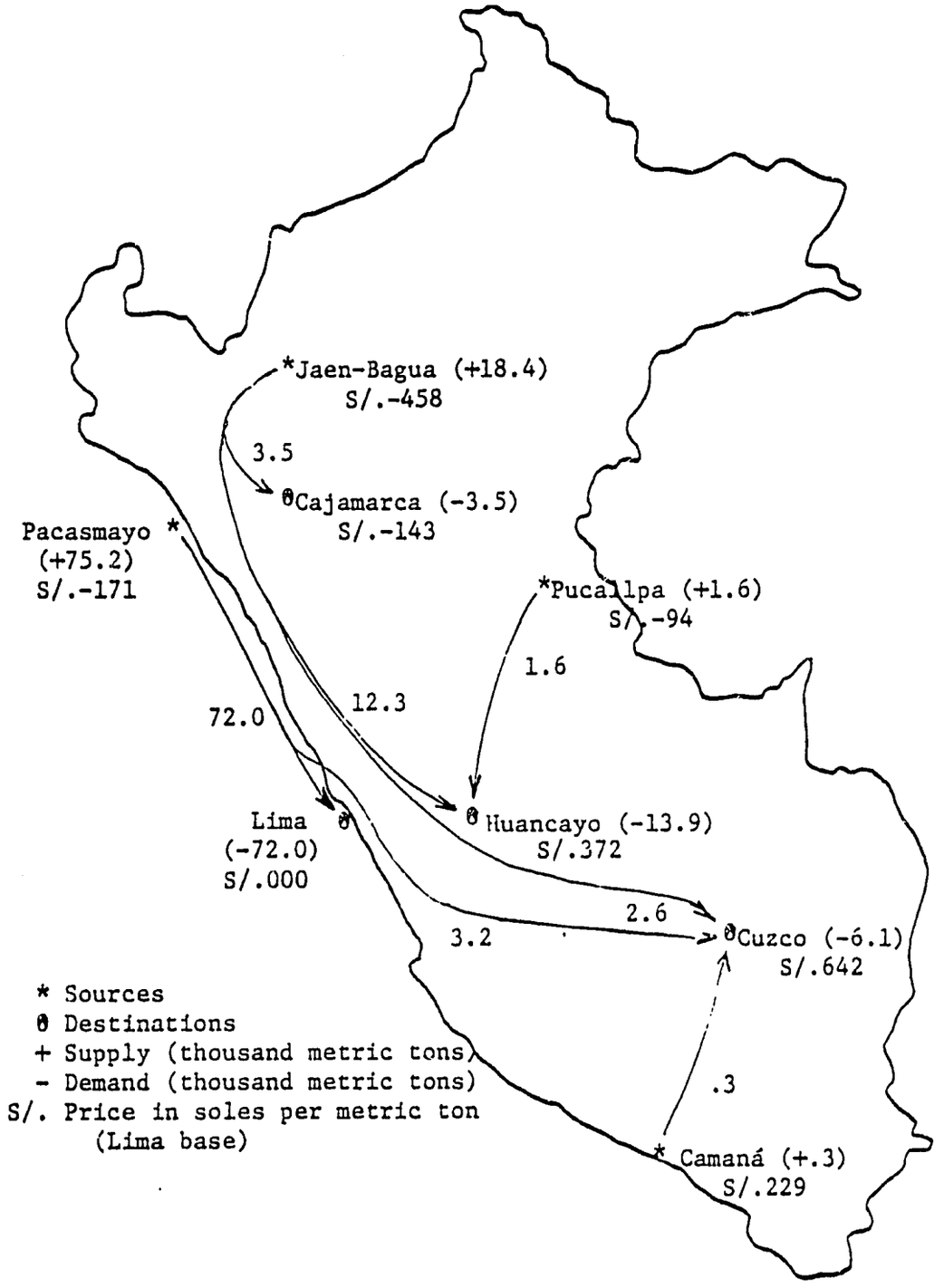

Figure 2. Allocation of rice supplies and regional price differentials, Perú

Table 2. Transportation cost matrix

Markets	Supply areas			
	Jaen-Bagua	Pacasmayo	Pucallpa	Camaná
	(soles per metric ton)			
Cajamarca	315	118	1,074	1,038
Lima	458	171	504	229
Huancayo	830	579	466	714
Cuzco	1,100	813	980	413

Source: Based on Mathia and Coffey (1965, p. 12).

are tied together through transfer costs. Should prices differ by more than transfer costs, there would be an incentive for new shippers to buy in the production area and sell in consumer centers. This reorganization would influence market supplies, raising prices in the market from which the supplies were withdrawn. Equilibrium would be achieved as price in that market rose and the heavier supplies on the first market depressed price there.

Divergencies Between the Model and the Real World

The reader may object that even these simple illustrations of the usefulness of the perfect market model which demands explicit consideration of spatial relationships of market price may be too complicated to be practical. Where is it possible to find the data needed to construct supply curves and demand curves? Where can transfer cost data be found in a country where the marketing research base is extremely limited?

The answer is that we must do the best we can with what is available. It is clear that if the effects of new transport systems on levels of consumption, production and market prices at various points throughout the country are to be measured there is no alternative to using informed judgments. The desire for a leap forward cannot be allowed to push into the background hard analysis of the economic potential of the several alternative highway projects that could be financed with a given capital fund, for example.

It may be further objected that lack of current market price information is such that observed market prices bear no relation whatever to the prices that would be experienced if fuller information were at hand. That line of reasoning might lead to the conclusion that the first item on the development agenda should be a more effective market price reporting system in order that existing marketing facilities might be used more effectively. But it cannot be argued that a model which makes it possible to examine spatial price behavior should be rejected because it does not exactly reflect the peculiarities of the real world. Some formal organizing framework is even more necessary in such a case than in a situation where well-behaved spatial price surfaces are readily apparent to the casual observer. The spatial model leads one to ask the "right" questions rather than providing easy answers concerning strategy selection. Often these questions are not being asked now because of the erroneous assumption that market prices are "spaceless."

THE TIME DIMENSION OF MARKET PRICE

The time dimension of market price is of critical importance in evaluating the potential profitability of new storage facilities. The fact that storage facilities have proved to be profitable in one region over a particular sequence of past market conditions does not guarantee that such facilities will be profitable either in that same region under different future market conditions or in other regions of a country. Again it is necessary to develop a model that will have predictive power to make comparisons of situations which have not been observed, such as the prices that might be experienced in the presence of a particular type of storage that is under consideration.

The profitability of grain storage, for example, depends upon the seasonal change in grain prices and the cost of storing grain from one time period to a later period. If in each year the change in price exceeds the added costs of operating a storage facility then the building of storage would be profitable. In many cases, however, experience with seasonal price changes will be mixed, with storage in some years being a profitable activity while in other years the sale of grain at harvest may turn out to have been the better choice.

To illustrate this point, the following data on corn prices for Eastern North Carolina may be of interest.

	1953-54 season	1954-55 season	1955-56 season	1956-57 season
		(cents per bushel)		
October 1	147	147	118	128.5
November 1	145	155	110	125
May 1	168	152.5	151.5	130

The reader will note that in the first season the price of corn increased 21 cents from October to May, the second season the increase was 5.5 cents, the third season 33.5 cents and the fourth season 1.5 cents. If corn can be stored for 5 cents per bushel it would have been profitable to store in three of the four years. However, if the cost of storage is 25 cents then sale at harvest time would have been more profitable in all but one year. The point to be made here is that storage facilities are not profitable everywhere in every year, even though the crop is readily storable and sufficient resources are available to construct, finance and operate such facilities.

The model used in the preceeding section of this paper can be used to summarize the forces influencing the profitability of storage in a simple two-time period case. A supply curve is drawn for the harvest period only and a demand curve is drawn for each of the two periods (Figure 3). The post-harvest period half of the diagram is dropped by an amount representing the cost of storage, comparable to the drop in the earlier diagram which represented the cost of transfer from one geographic region to the other.

The effects of storage can be summarized briefly. Without storage, the entire output would be consumed at harvest-time at a price represented by P_{ns}. After storage facilities are constructed, part of the output will be consumed at harvest-time and part stored for consumption in the post-harvest period at a price represented P_s. (The price paid in the latter period will be that received at harvest plus the cost of storage, represented by the drop in the quantity axis for the left hand side of the diagram.)

This highly simplified explanation of the time dimension of the market price for a storable commodity has the desirable feature of showing the

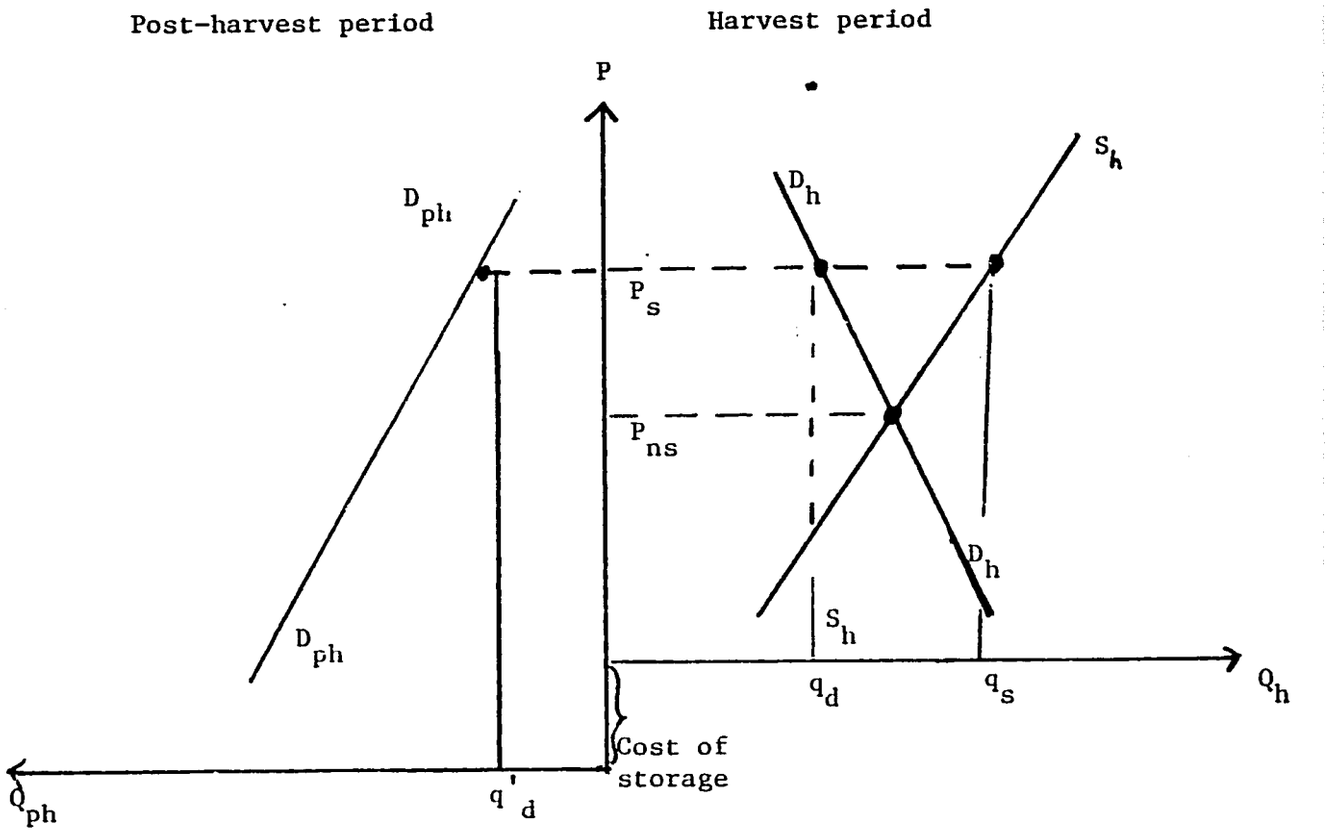

Figure 3. Illustration of the effect of storage on quantities produced and consumed and on prices in harvest and post-harvest periods

ingredients necessary for an evaluation of a proposed storage project, namely, the demand for the product at different points in time, the quantity of output that producers will bring to market as influenced by market price and the role of storage costs in the final outcome of the project. Some obvious extensions may be suggested. The cost of storage may not be identical at all potential sites for the facility. For example, a large facility may operate at lower cost than a small facility, but only if sufficient volume from surrounding producers can be assured. Small facilities may pay if local materials and manpower are available, or if local post-harvest requirements for the product may be met without lengthy back-haul from a larger, central facility.

These considerations point to the obvious desirability of combining the spatial dimension discussed earlier with the time dimension of market price. Without going into the details of a full mathematical illustration the general format that might be employed can be suggested. Suppose that given quantities of a commodity are produced in a number of geographically separated areas. Demands for the commodity can be estimated for each region in each of two or more time periods. The costs of transfer from producing to consuming regions are available, as is the cost of storage from one time period to another. The transportation model outlined earlier will permit the identification of product flows that would result under a perfect market allocation of the available quantities to meet the specified demands and also provides useful insights into where such facilities might profitability be located. Elaborate extensions of this model are in general use, but the logic upon which these extensions are based is that of the simple example provided here.

Perhaps the space-time dimensions of market development programming will be intuitively clear using a simple sketch of an area in which marketable surplus moves from Village V to a Regional Center R that is also served by a number of other village complexes (Figure 4). In this case, sellers in Farming Locality Town V can regard the price at R as given, and their net price will be that at R less the costs of transfer from V to R. The village, in turn, receives marketable surplus from a number of nearby producing areas S, T, U, etc. Producers in each of these areas receive for their commodity the price at the village less the costs of moving the product to from S or T or U to the village, V.

Two development projects are under consideration; project A is an improved road from S to the village V and project B calls for the construction of a storage unit at V. Clearly, both spatial and time dimensions of market price must be considered in making the choice between projects A and B. If A is chosen the net price to producers in area S will be improved by the amount of the reduction in transfer costs. Their incomes will rise by this amount multiplied by the annual volume of goods sold by producers in S at the village market.

Project B will have an impact upon all output flowing through Village V from the surrounding farms. The opportunity to store at harvest time instead of deliver all marketable surplus to the Regional Market Center R can be expected to have a beneficial impact on the price at V. However, this effect must be reduced by the unit cost of establishing and operating the storage facility in order to calculate the net effect of the project on price in the village and on net incomes to sellers from the surrounding farms.

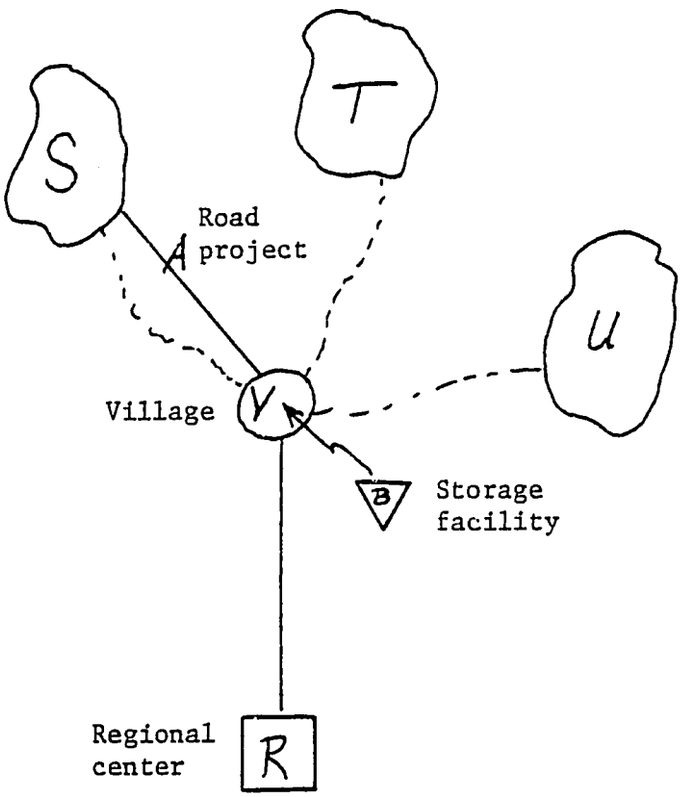

Figure 4. Sketch of producer groups S, T and U selling through Village V to Regional Center R.

Note that the road project has a direct effect on one group of sellers in the village while the storage project affects the price received by all sellers. Accurate quantitative estimates of the size of these price effects lies at the heart of the ordering and effective sequencing of market development projects.

THE FORM DIMENSION OF MARKET PRICE

The third dimension of market price that has particular relevance for regional development planning is that of form -- the relationship between the price of a raw product and its several marketable alternatives. Milk produced by dairy herds may move to market as raw milk for bottling purposes, may be separated for shipment to market as cream or may be transformed in the producing area into butter-powder or into cheese. Oranges may be sold as whole fresh fruit, processed into canned juice form or transformed into frozen orange concentrate. These various alternatives for canning, freezing or fresh sales must be compared in some way in order that proposals for product transformation may be evaluated before major plant investment projects are undertaken.

The most effective procedure for making such comparisons is to translate the prices for the several forms back into a net price for the raw product itself. It is seldom the case that such processed product prices are readily available to the development specialist who has in mind a particular project for a region in which processing activities have not yet been introduced. Therefore it becomes necessary to construct a set of prices that might be expected to result, much as it was necessary to evaluate the effect of a new road project on product prices in an area where production currently is not profitable.

The same general rules of market price behavior can be expected to prevail as were suggested for the spatial and time dimensions. The producing region will choose to process oranges only if the net price of the processed product is as great as, or higher than, the price that could be obtained for the unprocessed product. To make such comparisons, the

information needed will be (1) the market prices for the raw and processed forms and (2) the cost of transformation of the raw product to the processed form.

Let us first consider the calculation of relevant prices for the several forms in which a product may be sold. The model used to examine spatial price relationships is again useful here. Price data for regional market centers will be most readily available and may well include comparable prices for the several product forms. These prices are then converted to net prices for each production area using observed or estimated costs of transfer for the different forms. This provides the price data base for calculating the profitability of the processing plant proposal. There will, however, be instances in which price data is not readily available. In such cases, price information can be collected quickly through field surveys of the existing market system.

The second set of data needed consists of the cost of plant operation in the production area. While it would be very helpful if estimates of such costs could be assembled from interviews with managers of existing processing plants, in many development settings it is not possible to assemble such actual cost data. Therefore it becomes necessary to estimate or "synthesize" such costs.

Clearly, plant costs will vary with the technological processes that might be used and with the volume of operation that might be expected once the plant is placed in operation. Since plant volume is often difficult to forecast precisely, it will be necessary to calculate costs for a variety of output levels in order to identify the levels that would be necessary for successful plant operation. Judgment decisions must be made as to the likelihood that the required levels of raw product will be delivered to the plant.

In most real-world situations it will be found that the more bulky and perishable forms of a raw product will be marketed from producers located near to consumer centers while the less bulky and more readily transportable forms will be shipped from the more distant areas. The milk industry provides a well-recognized example of this with fluid milk sources found close to metropolitan areas while butter and milk powder production comes largely from more distant dairy areas. This is also observed in the processing of fruit and vegetables, although with improved refrigerated transport systems a large volume of fresh produce now moves across the United States in every season to supplement locally grown supplies.

A site-price surface will illustrate how net farm prices can be expected to vary with distance between producer and consumer center. The price received by producers will consist of the market price less cost of transfer from point of production to market. As shown in Figure 5, the farm price will fall as the distance from farm to market increases. Viewed from above, the resulting price cone can be represented by concentric circles representing equal net prices or isoprice contours (Bressler and King, 1970, p. 126). Given two markets, each with its own site-price surface, it is possible to identify the boundary between the two which suggests the efficient allocation of products as between the two market centers (Figure 6). Changes in the relative height of the two cones can be seen to shift this market boundary. Improvements in transportation systems resulting in lower transfer costs will raise the net prices received at each location and thereby encourage greater output and result in higher farmer returns.

Given the opportunity to market a product in two or more forms, the choice of most profitable form will be determined by the costs of processing. Optimum product form is established by comparing the net prices for each. Whether a processing plant will be profitable or not depends upon whether

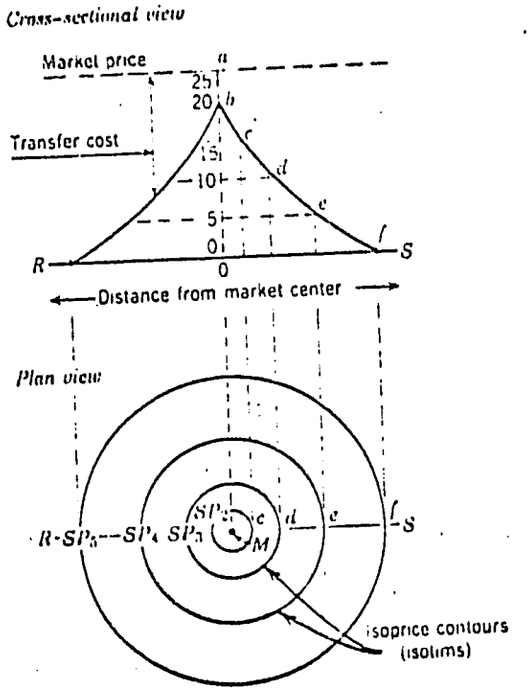

Figure 5. The site-price surface for a single market. (Bressler and King, p. 126).

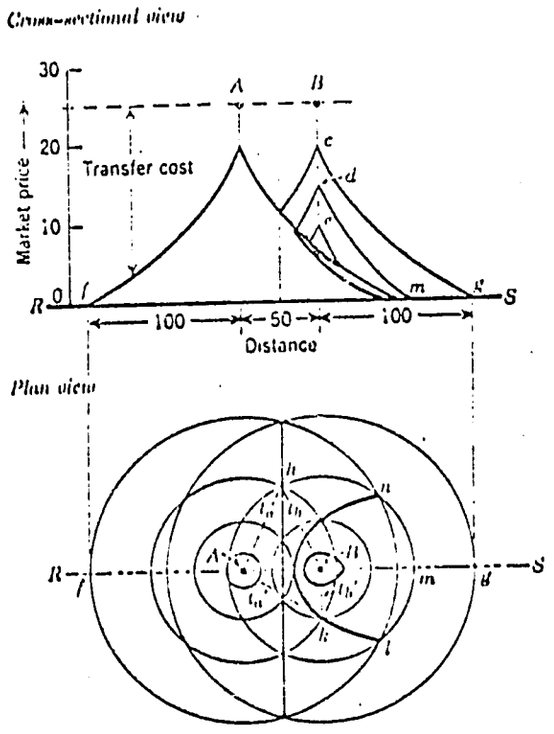

Figure 6. The allocation of production sites between two competing markets. (Bressler and King, p. 128).

the net farm price for the processed product will equal or exceed that of the unprocessed product. An example of this type of choice is suggested by the dairy industry where a choice must be made among such forms as fluid milk, cream and butter in each producing area.

If we neglect the cost of processing for the moment we can express the net farm price of a given quantity of raw product as the market value less the cost of transfer. If we assume that a hundredweight of milk can be sold as either 100 pounds of fluid milk, 20 pounds of cream or 5 pounds butter we can calculate the farm values as follows:

$$N_m = 100\ P_m - 100\ t\ D$$

$$N_c = 20\ P_c - 20\ t\ D$$

$$N_b = 5\ P_b - 5\ t\ D$$

where c, m and b refer to the three products, t refers to the cost of moving a pound of the product one mile and D refers to the number of miles the product is shipped. The cones illustrated in Figure 7 indicate that the more bulky product, fluid milk, will come from nearby areas, cream from the next zone and butter from the more distant producers. Processing plants would thus find it profitable to locate outside the fluid milk region where the net returns to cream and butter are lower than that for fluid milk.

Seasonal changes in supplies may also be considered (Figure 8). In the case of northeastern milk markets certain portions of the region profitably market milk in fluid form throughout the year. Other areas more distant from population centers supply the fluid market during periods of low production and sell milk in the form of cream during the flush season.

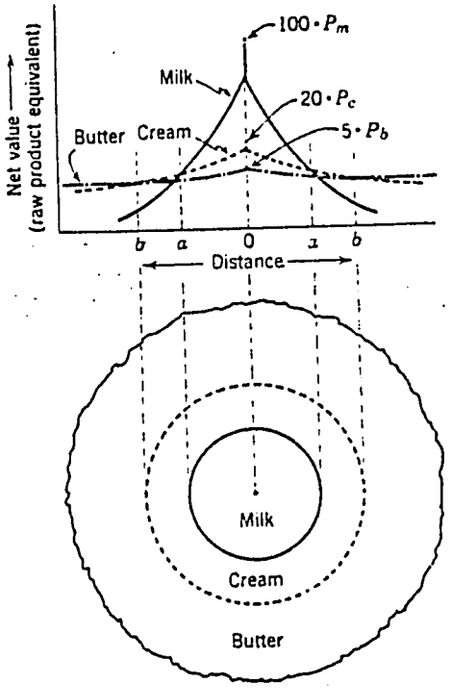

Figure 7. Efficient milk, cream, and butter zones around an isolated market (Bressler and King, p. 184).

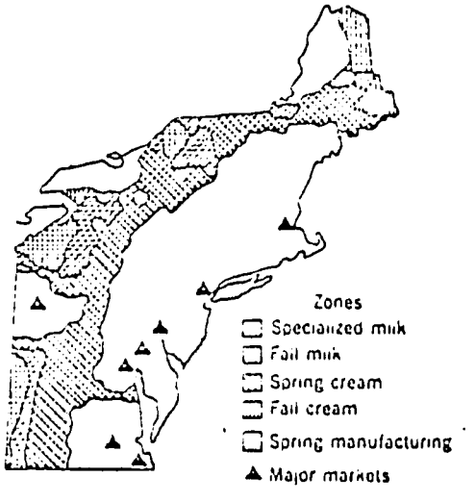

Figure 8. The efficient seasonal changes in milk, cream, and manufacturing zones for major northeastern milk markets, 1947 to 1948. [Source. William Bredo and Anthony S. Rojko, Prices and Milksheds of Northeastern Markets]. (Bressler and King, p. 196.)

Still more distant producing areas find processed products more profitable year-round. Selection of profitable milk plant designs clearly must take into account such spatial and seasonal characteristics of production and consumption patterns. Changes in supply and demand for milk and milk products over the past two decades have drastically modified these efficient product form patterns, but the usefulness of planning data of this type for market development decision-making is apparent.

Again it may be worthwhile to warn the reader that the model developed here is most useful as an aid in asking the right questions before a major development project is initiated. At best the model will only approximate observed behavior in the real world setting but it can assist in filtering out some of the primary forces at work in bringing about a continually changing set of market prices that have space, form and time dimensions. These, in turn, serve to guide the decisions of many individual buyers and sellers that result in observed storage, processing and shipping activities.

Attention should also be given to the constraints that may be at work to modify these decisions such as credit limitations, lack of good market price information, technical know-how and the social and political realities of the society. These vary widely from place to place and from time to time and serve to remind the development specialist again of the dangers inherent in direct transfer of successful market improvement projects from one setting to another without careful analysis.

APPENDIX

A FURTHER ELABORATION OF MARKET DEVELOPMENT STRATEGIES

Planning, Implementation and Evaluation Considerations

In designing strategies for product market development three facets must be considered -- planning, implementation, and evaluation -- PIE. The best starting place often will be an evaluation of the present situation. Some of the reasons why the perfect market model may not be consistent with the existing situation were discussed above. It is important to evaluate the reasons for the failure of the two to coincide before action is prescribed. For example, if the decision making process of producers and marketers is not price oriented or if the ownership of production facilities has an important role to play in determining the effect of a price change, a completely different set of recommendations may be in order than if the reason for the discrepancy is a specific public policy decision, lack of knowledge, or imperfections in the operation of the pricing system itself. Evaluation then is a first step in the development of a product market strategy.

The second step is that of planning. In the case of a product market problem the planning process would begin with identification of marketing regions. For each of these regions it is necessary to develop projected prices in form, time, and space dimensions as described above. Given these projected price relationships, regional development plans can be prepared. Some plans will be of a short-run variety in which existing plant capacity is regarded as fixed while others will be of a long-run type with expansion or complete reorganization of existing marketing facilities under consideration.

The third and equally important component of strategy is the implementation of these plans. The implementation of plans may be the responsibility

of the public sector or the private sector, but in any case plans must be sufficiently specific so that the implementation process is clearly spelled out.

Product market development strategy will include the three steps of planning, implementing, and evaluating. The best point at which to cut into this cycle will vary with time and place. The three steps represent a continuous series of operations that are never fully completed but, when successful, lead to the upward revision of goals and improvements in the execution of the revised plans.

Choosing Components, Systems or New Knowledge[1]

First it is necessary to identify the advance which is sought. In the case of the Peruvian agricultural sector this might be a given quantitative expansion in the food supply or a specified increase in the incomes of persons in the agricultural sector. Having identified the advance, it is then necessary to weigh the effects of (1) introducing new components, (2) introducing changes in the system within which these components are combined and (3) developing new knowledge. These three parts; components, systems, and the supply of new knowledge, must be woven together in such a way that product market development moves forward in the most efficient manner possible.

In the event that small changes in the present situation are sought, it might be feasible to concentrate entirely on providing new components. On the other hand, if major changes are desired, whole new systems of marketing may need to be introduced. The problem is to select those projects for which the payoff will be highest, given the advance which has been set as the goal of the development effort.

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[1] In a recent paper, Nelson (1966) offers a useful framework for considering the specific ingredients of a product market development scheme.

Differences in product characteristics must be considered in preparing market development plans. Industrial crops such as cotton, sugar, coffee, tea and perhaps wool and manufactured milk are marketed under arrangements quite different from those for storable foods such as potatoes, beans, rice and corn and from the handling of perishable foods such as vegetables, fruit, and fresh milk. In the initial stages of development, efforts may be concentrated upon the storable foods in order that unreasonable seasonal variations in prices of beans or corn may be eliminated through more satisfactory storage plans. Or it may be that a wholesale food market needs to be constructed in order to reduce drastically the cost of marketing perishable fruits and vegetables. For many industrial crops it may be found that the marketing system is already reasonably efficient as compared with other nations of the world and these crops might well be left for consideration at a later date.

Another characteristic of agricultural products to be considered is the time dimension of the production process. There are certain crops such as tea, coffee, bananas, cacao and fruit for which long-run planning of marketing methods and facilities is necessary. For products such as beef cattle, dairy and poultry a shorter planning period may be relevant while for annual crops such as potatoes, rice and vegetables short-run decisions with regard to production and marketing methods must be examined.

There will be situations where relatively little is needed in the way of marketing facilities. McPherson (1965) reports that the construction of an all-weather road north from Quevedo, Ecuador, was sufficient to encourage rapid expansion in banana production, not only along the newly-built road but in areas well ahead of its completion. Since neither irrigation nor

drainage investment was required, individual families were able to make the entire investment that was required upon being assured that the road would be completed by harvest time.

In any case, it will be necessary to identify marketing regions for the commodities selected for the initial attack. Price projections for these regions must be developed in form, time and space dimensions and the specific projects to be considered must be spelled out. It is also clear that there may be some substitution involved in making a decision to develop the marketing system for industrial products before that for storable foods or perishable foods. Such decisions turn on the desired advance.

The improvement of product markets should be an important component of any plan which seeks to accelerate the rate of economic growth in a region. The plan for product market development must be short run in nature, consistent with long-run goals, subject to frequent revision, acceptable to government, acceptable to private marketing firms, and acceptable to producer groups. Considerable effort will be required to insure proper implementation of the plan once the plan itself has been prepared and adopted. Evaluation must be recognized as a vital step in the threefold process for achieving product market development -- planning, implementing, and evaluating.

A Proposal for Planning Market Improvements

We have not fully exploited our analytical models for market improvements, even in this country. Over a quarter of a century ago F. L. Thomsen made these observations after reviewing 589 published marketing research reports.

"... After 40 years of marketing research we know a great deal about how products are marketed, the nature of the operations of agencies through

which commodities move, and the reasons why marketing costs are incurred, but we still have not shown how to make substantial improvements in marketing. The research bulletin which contains a suggestion promising to effect a material reduction in marketing costs or a really worthwhile increase in the usefulness of marketing services is a rarity. The conclusions and recommendations found at the end of some bulletins frequently are but common sense observations which would have been made before the 'study' was begun..."[2]

It is interesting to note his suggestions for improvement. Thomsen recommended that research workers "abandon stodgy descriptions and particularizations of the obvious" and adopt a problem-solving research method which he described as three steps: "...first, to inventory problems likely to be encountered; second, to formulate hypotheses regarding possible solutions; and, third, to subject these hypotheses to objective verfication by controlled experimentation." He then outlines an ideal problem-oriented research project in which the researcher obtains industry views and studies literature to find out how a present way of performing a marketing activity may have defects. The worker then sets out to develop better ways by exploring various alternatives and selects the alternative or alternatives that appear to offer the best prospects for improvements. Finally, the researcher persuades someone in the industry to try out his suggestions to discover their hidden defects and further improvements that may be needed.[3]

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[2] F. L. Thomsen, "A Critical Examination of Marketing Research," Journal of Farm Economics, Volume XXVII, Number 4, November 1945.

[3] W. R. Henry and R. A. King. Research Workers' Viewpoint of Regional Marketing Research, Proceedings, Marketing Section, Association of Southern Agricultural Workers, Jacksonville, Florida, February 1962.

This viewpoint is consistent with the ideas presented in a recent IICA manuscript drafted by Mr. Moran entitled "Hemispheric Agricultural Marketing Programs" (December 1972). Emphasis in that manuscript is placed on "reinforcement of national institutional systems serving agricultural sectors" (agricultural firm management topics are excluded). The primary objective is "more effective coordination of agricultural production and distribution systems" given specific country objectives.

The question which remains to be answered more fully is how to best go about identifying "system expanding opportunities" to deal with "inefficient and poorly organized marketing systems." The strategy proposed in the IICA paper is that of "reinforcement of the institutional systems serving the agricultural marketing sector in Latin American countries" through (a) technical and research assistance to national institutions and (b) training programs through a four-phased sequence of activities.

Emphasis here is placed on the use of market price relationships as a key input for firm location and enterprise choices. Three priority levels might be appropriate for country program planning. Actual investigation and programming in individual countries may consist of different mixes of the three, but the general order of priorities is as follows:

Priority No. 1. Describe existing marketing systems

Priority No. 2. Evaluate existing marketing systems

Priority No. 3. Develop detailed plans for action.

Priority No. 1. Describe Existing Marketing Systems

OBJECTIVE: To identify the characteristics of existing systems by (a) measuring product flows from producers through intermediate handlers to consumers and (b) constructing price surfaces associated with these flows.

JUSTIFICATION: Until we understand how a system presently operates we have no basis for evaluating the potential effects of alternative structures and policies on producers, consumers and marketing firms. A clear description of the present system will provide immediate benefits through improved communication among policy makers. Differences of opinion that arise from inconsistent views of the present situation may thus be reduced.

PROCEDURE:

(1) Rank products or product groups in terms of their importance to the agricultural sector and thus their priority for marketing research resources.

(2) Establish a network of producing regions and trade centers to be used in measuring system performance for each group.

(3) Estimate (quarterly?) rates of production, processing, consumption, exports and imports using a form-time-space framework for each product or product group in order of rank established in (1) above.

(4) Construct price surfaces which incorporate form, time and space dimensions for the networks developed in (2) above which are consistent with the flows identified in (3) above.

Priority No. 2. Evaluate Existing Marketing Systems

OBJECTIVE: To identify suspected sources and approximate sizes of inefficiencies and rank products and regions with respect to opportunities to remedy "inefficiencies and poor organization."

JUSTIFICATION: The "search for unexploited economic opportunities" within existing marketing systems will lead to preliminary conclusions concerning areas for immediate attention. These will serve as a basis for focusing research and extension resources on critical areas to provide detailed recommendations for increasing productivity and improving overall performance of the system.

PROCEDURE:

(1) Develop estimates of costs of performing selected marketing services for each activity in the system.

(2) Compare these costs with price relationships developed in the initial research effort to identify those products, regions and processes for which there appear to be important deviations between the two.

(3) Use transportation LP models, reactive programming or other market equilibrium estimating methods to compare "perfect market" flows and price relationships with those observed under the existing system.

(4) Prepare a preliminary ranking of improvements in the system which appear to have high payoff.

Priority No. 3. Develop Plans for Action

OBJECTIVE: To prepare a detailed plan or plans for agricultural market improvement over a 3 to 5 year period including resources needed and expected payoffs.

JUSTIFICATION: The third phase of the research plan will provide policy makers with specific details of proposed actions for each product group and each producing and consuming region of the country with

insights into the size and incidence of expected benefits from each for the several participants in the system.

PROCEDURE:

(1) Select region- and product-specific proposals for detailed investigation.

(2) Estimate the time paths for investments and impacts of each proposal and specify the resources required for successful performance of the projects.

(3) Measure the expected costs and benefits to each participant group in the system.

(4) Indicate the appropriate institutions, agencies and firm types to carry responsibility for each project.

(5) Outline a procedure for monitoring the project both in developmental and operational phases which will be sufficiently responsive to allow reorientation or abandonment of the effort, should that be indicated.

Payoff to Regional Development Strategies

To make effective use of limited resources it would seem to be desirable for both AID and developing nations to concentrate on designing market improvement programs that are region-oriented. For example, a proposal to institute similar marketing programs on the Eastern Shore of Maryland and in the mountainous western portion of the state would have little credibility. This is equally true in the developing nations of the world. Furthermore, manpower and monetary resources are unlikely to be adequate to simultaneously attack the problems of every such region. The

need for setting region priorities has been emphasized in a study of Peru (Coutu and King, 1969) and in many other places.

The second argument for regional priorities is that the benefits flowing from any market improvement plan will be highly region-specific. There is no single remedy that will solve every agricultural marketing problem in this nation or any other. Variations in natural resources and relative prices are reflected in widely different product mixes and in location-specific opportunities for market development.

Timing of critical development components can be much improved through regional market development planning. The benefits that might be expected to accrue from new marketing facilities may depend upon the presence of technical assistance in appropriate variety selection and properly preparing products for market. Commitment to a package of market development components may be as critical as a package of farming practices to raise output. The mix of marketing components needed can be expected to vary widely from region to region.

Given the natural desire to see all parts of a nation move forward, consideration must be given to means for gaining acceptance for region-specific plans. Early efforts in a region might be offered as pilot or experimental market development projects from which lessons might be learned for later application in other regions. Failure to assure public support for region-specific market development programming can endanger project investment plans that otherwise would have a high probability of success.

Relevance to AID/Agribusiness Development Programming

Region-specific market development programming based upon the form-time-space market models presented here might be incorporated in a variety of ongoing activities in AID. These include:

1. Design of feasibility studies.
2. Programs for training middle management.
3. Institution-building programs.
4. Timing of capital investment projects.
5. Evaluation of research base for development plans.
6. Planning for AID/LDC specialist cooperation.

Without going into details as to how such activities might be structured, the argument presented in this paper has been that a market price oriented framework in which form, time and spatial aspects are explicitly taken into account can serve as an effective focus for planning, implementing and evaluating development efforts.

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