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POLICIES, PLANNING  
AND MANAGEMENT  
FOR AGRICULTURAL DEVELOPMENT

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## SPECIAL GROUP N

*Chairman:* J. Raeburn U.K.

*Rapporteur:*

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### *Recent Advances in Research Methods in Marketing\**

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In the industrialized nations, the processes of getting food from the farm to the consumer is increasingly complex. It involves the physical handling, processing, packaging, and transportation of products. It involves also a web of business relationships—accumulation and use of resources and products, transfers of ownership of products, pricing of products and services, financing, exchange of information, organizations and contracts, and many others. All of these make up the marketing system for farm products and all are topics for marketing research.

Markets for farm products change constantly with changing population, changing technology, and changing demands for quantities and qualities of goods and services from the agricultural industry. Change brings the need for adjustments in the use of resources. Such adjustments create problems for individuals and for society. Marketing research basically focuses on these adjustments. It properly addresses itself to the problems of people as they strive to adjust to the ever changing economic climate within which they must live and work.

Technological and economic developments seem to have a particular spite against tidy, comfortable concepts about marketing. Hardly has the ink dried on some of the most sophisticated adventures in market analysis before market changes generated by technological applications turn them into historical treatises. Without the incorporation into methodology of some anticipatory recognition of changing technological frontiers, market research runs the risk of turning out updated versions of retrospect . . . whether addressed to a product or to the market in its entirety.

Two developments in recent years characterize marketing research. One of these has been the need to focus on marketing problems of an industry or a major sector of the agricultural economy in contrast with marketing problems of individual firms or of relatively small groups of producers. This change causes some consternation among research economists, because it forces them beyond the rather comfortable ambit of the 'theory of the firm' into the broader and less well explored region of macro-economics. Here, the problems are more numerous and more complex; the accepted theory less

\*The author is deeply indebted to Dr. W. T. Manley, Director, Marketing Economics Division, ERS, and to his staff for substantial aid in preparing this paper.

useful in formulating testable hypothesis; and even the data for empirical analyses are either not available, are less well adapted, or are difficult and expensive to obtain.

A second major development grows from the development of computers and the capacity they provide for simultaneous solutions to big and complex sets of equations, plus the growing sophistication of 'software' necessary to exploit the computational capacity of electronic data processing.

As marketing research people are forced to examine broader and more complex economic problems, they have increasingly sophisticated computers and software to use as research tools. The lagging ingredients seem to be our theoretical concepts, our ability to use sophisticated techniques most productively, and our capacity to acquire relevant and adequate data.

### *Explorations in Product Valuation*

'Know your product' is a time honored maxim in nonagricultural marketing circles. But agricultural marketing economists often cling to the myth of the 'homogeneous product'. Analyzing differences in the attributes of a product engages many technical marketing researchers. Yet economists commonly conduct commodity demand studies as if a potato were a potato, a tomato a tomato, etc. After using stereotyped approaches to aggregation, they are puzzled to find that their model doesn't perform too well for real situations outside of model data experience. Technical improvements in measurement of attributes of agricultural products make the use of generalized product definitions in economic research less excusable.

Many farm products in the United States and in other countries are subject to administered pricing mechanisms of one form or another. Experiences with commodity programs amply demonstrate that administered prices and market values often can become misaligned resulting in poor performance in both production and marketing. Thus, these programs offer fertile opportunities for economic research.

The Economic Research Service, United States Department of Agriculture, in co-operation with other agencies and universities with related commodity interests, has undertaken an expanding program of research to improve our knowledge of the relationships between product quality and the operation of the market for the commodity under scrutiny. Let me give a few illustrations of such work.

In the United States, support prices of peanuts at the farm are established using a grading system that recognizes varying proportions of different types of kernels in a given lot of peanuts. Peanut shelling firms, who sell their product on the basis of specific milled grades, must purchase their basic raw material in the form of mixed in-shell grade lots which may vary considerably in kernel grade composition.

Because of the form in which farmers' stock peanuts are acquired by shellers, it is not possible to estimate the sheller demand functions for specific kernel grades by standard statistical techniques. Consequently, researchers have developed a linear programming model that specifies the optimum

quantity of each kernel grade that the shelling industry 'should' purchase. This is accomplished by allowing the model to 'purchase' each kernel grade independently. The model is constrained by the estimated demands for milled peanuts in each of the major end use categories. This model is capable of generating estimates of the optimum shelling industry acquisitions of farmers' stock peanuts for any set of kernel grade price relationships.

A second linear programming model was developed to simulate the peanut shelling industry's actual market activities. This model differs from the first in the manner in which it buys farmers' stock peanuts. It 'buys' its peanuts from the estimated *actual crop* in mixed grade lots. In all other respects, the two models are identical. A set of farmers' stock peanuts, each of which represents a different kernel mix, or quality, was developed from crop grading data. The quantity of each kernel grade is restricted by the quality distribution of the crop. This model generates estimates of the quantity and quality of farmers' stock peanuts by grade that will be purchased by the shelling industry under any set of price relationships.

By using the two models together it is possible to evaluate the efficiency of various kernel grade price relationships. We can tell how well administered prices at the farm level for various grades of peanuts reflect 'true' market values. This is done by comparing the solutions of the two models. The closer the two solutions for a given set of kernel grade prices come to being identical, the more efficient is that price set. If the two solutions are identical, the price set may be considered optimum in the sense that the administered prices accurately reflect the market values of the several kernel grades.

Work is currently underway to expand this analysis into a national model of the U.S. peanut industry. With it, we can evaluate grade-price relationships for each type of peanut and can better establish price differentials among the several types of peanuts and producing areas in the United States.

Elaborate analytical schemes are also being worked out for cotton and wheat. For years, pricing of cotton has been based largely on 'grade and staple' and pricing of wheat on protein content, amount of moisture and foreign matter, and test weight per bushel. But new technology has made these bases for pricing totally inadequate for accurately translating real quality differences into prices compatible with demand.

Existing methods and procedures for evaluating quality of cotton do not provide for measurement of all quality factors significantly affecting the 'use value' of cotton, nor for a means of translating 'use value' into prices. This problem has been approached by building a well-equipped laboratory that simulates commercial cotton milling operations. Here, cotton technologists, engineers, and economists have been brought together as a team. Here, they strive to (1) determine quality factors affecting the cost of processing cotton and the 'use value' of cotton products; (2) develop better measures of relationships among quality of cotton, processing techniques, processing performance, cost, and value of the end products; (3) develop test instruments to measure variations in quality; and (4) develop a more effective pricing and marketing information system for cotton based on measureable quality factors.

Combining the talents of various specialists and leaning heavily on marginal analysis and the analytical tools of linear and parametric programming, the researchers have developed and are testing an experimental model. The model optimizes mill purchases of various cottons consistent with requirements of different end products taking into account relative price differences of raw cottons and of milling techniques on product cost. Cotton processing experiments in the laboratory, incidentally, revealed that fiber properties interact significantly with machine settings and processing regimens. This is but an example of the technical complexities that need to be dealt with to obtain a true evaluation of a cotton's processing performance.

Although research has brought a simulated facsimile of a textile firm within reach, the goal of a model of the entire industry is some years away. However, general use of the current firm model should result in improved utilization efficiency and more realistic pricing of cotton.

The underlying need for quality evaluation of wheat is similar to that of cotton but is complicated by the number of joint products obtained in milling. The quantity of each of these products may be varied through use of different wheat mixtures. Quality analysis for wheat to date has been confined to the evaluation of properties affecting the baking performance of wheat in white bread—the largest domestic market for hard wheats. Similar work for other wheat products is in the offing.

A returns optimizing model has been formulated in a linear programming format for indicating the quantity and type of each wheat to use, the amount and type of product obtained from a wheat mixture, and the amount and types of products produced. Model construction is being extended beyond processing and appropriate coefficients are being developed for additional accommodation of assembly and distribution functions.

For both cotton and wheat, the ultimate aim is to devise analytical schemes sufficiently complete to yield meaningful evaluations of differences in use values.

#### *Explorations in Market Organization*

Technical innovations in processes and services in production and marketing of farm products force adjustments throughout the entire agricultural system. Technical refinements that permit greater control of volume and quality of products promote vertical co-ordination in a number of agricultural industries. Under such circumstances, integrated research using systems analysis offers the most promising approach for gaining meaningful insights into market performance.

One illustration of new research in this direction is a co-operative project being developed between economists in the Economic Research Service and economists at universities in the important hog producing States. We are striving to model, in econometric terms, the entire swine production, processing, and marketing industry of the United States. This project will be a team effort.

Production economists working on swine breeding and growing will develop supply response functions by types of enterprises. Similarly, the

researchers concerned with feeding systems and slaughter plant operations will devise behavioral functions for these elements of the system. Concurrently, demand functions for individual pork products will be estimated by those participants interested in this aspect of the research. With these research outputs available simultaneously, the model building members of the co-operating team can construct a behavioral image of the economic organization of the system.

Once operative, this innovation can be used on the computer to accommodate a variety of problem situations. Production economists can obtain readings on the effect generated by new supply functions identified with new types of farrowing or feeding enterprises. Market structure researchers can use it to simulate the effect of introducing structural change through alternative types, sizes, and functions of the firms involved. Domestic effects of policies aimed at promoting new foreign markets for pork can be introduced into the model.

We seek most, however, an assessment of technological and economic forces pressing for change in the organization of the swine industry, and an evaluation of what alternative changes could mean to performance of the industry.

The momentum of interest, in the research community, in market performance is causing our research people to branch out and extend beyond product subsectors in agriculture. Not content with the interpretative limitations of classical notions of market performance, some researchers seek to define and develop new measures. To encourage this basic pioneering effort, we are funding several projects being carried out at other research institutions.

Interest in market performance research has led to the proposal of two new measures. One measure seeks to quantify the degree of match between the supply and demand for both products and marketing services at the consumer level. A game approach is being used to determine the degree of match between the retail services preferred and offered within a given market area. The game is constructed to introduce costs of retail services and budget constraints of customers into decision-making process.

The other proposed new measure of market performance attempts to develop an index of consumer satisfaction. The numerator of the index is viewed as an aggregation of benefits as perceived by consumers and the denominator is viewed as an aggregation of costs as measured by the 'consumer price index'. This measure is designed to give an indication of changes in costs and benefits over time rather than a precise indication for one particular point in time. However crude such an initial measure may be, comparison over time may provide some insights into the benefits and costs generated by the marketing system

### *Economic Organization*

In our increasingly complex economic system problems of marketing become both more important and more difficult of resolution. The intricate,

interrelated chain of events between primary producers and final consumers places new demands on marketing research. We can no longer be content with our work on engineering efficiency of specific steps or processes or with micro-economics of marketing firms, or even with descriptions of market structure. The entire economic system, from input suppliers at one end, to consumers at the other, is becoming so intertwined and so sensitive to economic and technical changes that we must develop new approaches to marketing research and be prepared to use such research to help resolve public policy issues as they arise.

Growing public concern over quality of products, growing public demand for services associated with products, and growing public involvement in regulations, prices, tariffs, transport services, and other features of marketing, force our research into new fields where adequate theory and methods have yet to be developed. To be more specific, one perplexing question is how to identify better the price making and resource allocating roles of markets in the agricultural industry. Some very basic research needs to be directed at the public issues concerning use, development, and allocation of resources among the participants in production and marketing of food and fiber products. Other research needs to evaluate such institutional features of marketing as restraints on trade, quality classifications of products, financing of both marketing facilities and goods in marketing channels.

Despite much good research in marketing in recent years, the horizons are broader, the needs greater now than ever before. Marketing research people will not complete all their tasks soon—more likely we will have more unanswered questions a decade hence than we have now.

## SPECIAL GROUP N REPORT

### *Discussion*

The discussion was introduced by F. Grüber of (West) Germany who regretted the very small selection of analytical methods in the Uchurch paper and tentatively questioned whether the growing demand for a shift in emphasis in market research from the macro to the micro level might not be the expression of progress in market research itself.

F. Grüber meant by progress in market research partly development and further development of analytical methods and partly developments in their use and usability. From this point of view he lead on to a series of analytical methods and examples, beginning with the growing appreciation of the advantages of systems analysis for gaining insight into qualitative and quantitative relationships. In this connection an empirical analytical procedure was described where an overall model was broken down into several part models by the use of traditional regression models, by recursive and quadratic programming, and by a transport model. The idea of breaking down a larger model into several part models appeared in a systematic form in the block-recursive model of Professor Fisher. This model enabled an isolated



mathematical/statistical treatment to be used in estimating parameters for each individual part model and had recently found a number of applications. Because this type of model came significantly closer to reality, it would contribute to important advances in market research.

Continuing, F. Grüber referred to the further development of the system of interdependent equations taken up by Professor Wold. This initiative to a new iterative method of estimation by avoiding reduced (simplified) forms made it possible to estimate the parameters in any chosen structural equation of the interdependent system. (The crucial problems, however, arise in the use of the estimated individual equations for economic forecasts. The overall model must then be brought into use).

Progress in methods of research in market economics also includes the fitting of linear regression models as limits to decision models. As a result a dynamic decision rule with a recursive time lapse is obtained for a given set of conditions. In addition, F. Grüber mentioned a whole series of other advances in analytical methods and practice over the last decade and, in particular, drew attention to the growing interest in spectral analysis.

In the further discussion attention was drawn to new research methods for the analysis of consumer behaviour. The importance of these research methods lies, among other things, in the fact that their use is often an essential preliminary for a later meaningful analysis of demand. On the other hand, the intellectual benefit which underlies these research methods is often their great worth in evaluating the results of a demand analysis.

Continuing the discussion, attention was drawn to the growing importance of regional and particularly of interregional analysis. The continuing wide spread extension of this type of analysis was due to the availability of various programming models and increasing understanding of their possible applications. In this field the recursive programming model was of particular importance because it was best able to take account of the dynamic nature of price-quantity relationships for agricultural products. Because of this and because of the interregional model concept, this type of model was considerably more realistic than earlier, mainly stochastic, models. Naturally this increased the practical usefulness of such economic analyses and because of this, this type of interregional analysis and economic forecast had recently received increasing attention in economic practice.

Finally, a warning was given against regarding every refinement in mathematical models as a step forward in research methods in market economics. The decision as to whether an available mathematical model could be suitable for research in market economics, or whether it remained purely mathematical, would always depend on whether or not it could provide a useful mathematical picture of economic relationships in the market in one or more cases. In this context 'a useful picture' is taken to mean one which extends our insight into economic relationships. Unfortunately sufficient attention is not always paid to these conditions.

Among the participants in the discussion were:

F. Grüber *West Germany*, J. Kirk *U.K.*, V. Demyanenko and V. Martynov *U.S.S.R.*