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**VERTICAL COORDINATION OF FOOD SYSTEMS  
AND COMMODITY SUB-SYSTEMS**

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## Introduction\*

This paper focuses on the problems of organizing and managing food commodity systems in a dynamic environment where flexible prices and other incentive mechanisms play an important role in coordinating production and distribution processes. The first part of the paper develops a conceptual perspective of vertical coordination of food systems in the context of economic growth and development and relates this to the recent and projected Chinese situation. The importance of the public sector's role in planning and guiding food system operations within a medium to long-term strategic development plan is assumed in this conceptual statement. The second part of the paper describes the methodologies we have developed and used in the U.S., in Latin America and Africa for identifying problems and opportunities for improving food system performance. This is followed by a brief summary of our experience in applying these research methodologies in selected countries. The paper concludes with a suggested set of research questions that would seem to be relevant to the current efforts to stimulate the future development of a progressive, efficient and equitable Chinese food system. Since I have limited knowledge of the Chinese food system, I will emphasize approaches that we have found useful in addressing food marketing problems in other countries.

## Vertical Coordination of Food Systems

A basic set of problems that exists in all national food systems is how to achieve a reasonable matching of supply and demand given biological uncertainties and the institutional complexities of a changing economic environment. The changing environment typically includes increasing population pressures, rising levels of income and the need to expand food supplies. Broad food system performance goals usually

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include the following along with other more country specific objectives.

1. To achieve an abundant, nutritious and reliable food supply at economical prices.
2. To promote and facilitate the production and distribution of the combination of foods and related services that best reflect consumer preferences and real relative production costs.
3. To stimulate the development and adoption of improved technologies and organizational arrangements that will lead to increased resource productivity in all aspects of food production and distribution.
4. To stimulate the creation of productive and remunerative employment opportunities.
5. To create the conditions necessary to ensure equitable exchange relationships.
6. To discourage uneconomic uses and spoilation of natural resources and the environment.

In the more developed countries there has been a long-term industrialization process wherein the creation and adoption of new technologies and new institutional arrangements has led to greater specialization of labor; increased labor productivity; shifting employment from farm level food production to service industries; population migration to towns and cities; rising levels of income; shifting patterns of food consumption and a rapid increase in the demand for marketing services. The shifts in demand call for new food products, higher quality products, more convenient shopping arrangements, relatively greater increases in the production of livestock products, fruits and vegetables and decreased per capita production of basic grains and starchy tubers.

The growth of large urban centers and secondary cities has been a dominant force in the transformation of food systems in many countries. As demand grows, the geographic supply areas expand, and there is a trend towards greater regional specialization in agricultural production. This generates a growing demand for

investments in transport, storage and market facilities and the development of complementary institutional arrangements for assembly, processing and distribution of food commodities.

Vertical Coordination is a term that I am using to include all the ways of adapting and harmonizing the various stages of production and distribution within a commodity system that is responding to changing supply and demand conditions. Flexible market prices may provide the primary means of coordination but must be accompanied by institutional mechanisms and policy guidelines which involve varying degrees of public sector participation. Hence, the central political-economic question is how should the market system be instituted to achieve desired performance. What should be the role of government and what would be the most effective approach to create the incentives and to provide the support and guidance for a progressive, efficient and equitable commodity system?

In a market directed economy prices and related information serve as critical messages to farmers and managers of units that process, transport and provide wholesaling and retailing services. If the system is well coordinated, prices will move up and down with biologically based patterns of production and other market forces. Price differences between different locations in the market area should reflect actual differences in transfer costs. Seasonal price variations will bear a close relationship to storage costs or, in the case of perishables, to seasonal differences in costs of production. Price spreads between raw products at the farm level and prices paid by urban consumers will be closely related to the actual costs of providing the necessary marketing services. Returns to farmers should be sufficient to call forth the quantities and the quality mix of products that will satisfy consumer demands in the sense of clearing the market without significant surpluses or shortages.

There are various institutional mechanisms for facilitating vertical coordination within commodity systems. These mechanisms can also be instruments for introducing

cost reducing innovations in arranging transactions and in physical handling of products. Specific coordinating mechanisms include open markets where prices are established through negotiations between buyers and sellers, cash markets where prices and/or marketing margins are government regulated, and various forms of forward contracting designed to reduce risks and lower transaction costs (Minot, 1986).

Prior to 1978 the Chinese marketing system for perishable commodities was organized around rural supply and marketing cooperatives that collected products from communal production units and delivered shipments to urban-based municipal food companies. The transactions and physical movement of products was coordinated through forward contracts that specified quantities, qualities and prices. The municipal food companies distributed products to urban consumers through a network of specialized retail food markets (Abbott, 1977).

Since 1978 the marketing system for perishable commodities has been significantly modified to permit freer movement of prices and opportunities for opening new marketing channels involving direct sales by individual farmers to private traders and/or consumers. This change in policies has been accompanied by increases in prices for fruits, vegetables and livestock products, expanded output and much higher incomes for farmers who could take advantage of the new situation.

I have the impression that the organization of the Chinese production, processing and distribution systems for all agricultural commodities is still very much in a state of transition to the new policy framework. Institutional arrangements usually respond slowly. Transportation and infrastructure-type facilities are no doubt lagging behind actual and potential needs. Although the forces of change are at work it will take considerable time and effort to achieve the desired performance results. Meanwhile, there appears to be a need for studies to support the design of policies and programs to guide the development of more productive and well coordinated commodity systems.

### Methodologies for Diagnosing Commodity System Coordination Problems

Over the past several decades the agricultural economists in the United States have developed and made extensive use of a variety of analytical methods for diagnosing market system problems. The methods range from descriptive, qualitative assessments to more quantitative econometric and simulation models. While each of these methods have potential usefulness, it often requires a combination of techniques to effectively analyze the more complex food system organization problems. However, the fundamental concept of a food system provides the analytical framework for diagnosing problems and formulating strategies for improving food system performance. A food system has both vertical and horizontal dimensions. In a vertical plane it includes all the activities that link farm-level production to the final consumer. In a horizontal plane it includes the organization of activities among participants at a particular level within the system such as processing, wholesaling or retailing. The advantage of viewing market processes in a food system context is that we can identify constraints and possible opportunities for improving system performance, taking into consideration the dynamic interactions that will occur in response to changes in policies, institutional arrangements and technology utilization.

Over the past decade a group of agricultural economics researchers from several universities and the U.S. Department of Agriculture carried out a coordinated set of studies under a project entitled, Organization and Control of U.S. Food Production and Distribution System. Important outputs from this project included a wide range of publications culminating in a book, The Organization and Performance of the U.S. Food System (Marion and the NC-117 Committee, 1986). I call attention to this research effort because of its contribution to the development of methodologies that could be adapted to the Chinese situation. Of particular interest is the "commodity subsector" study approach. This approach has also been developed and used in several Latin American and African countries by our Department of Agricultural Economics faculty at

Michigan State University working in collaboration with professionals within specific countries including Brazil, Colombia, Costa Rica, Senegal, Mali and Rwanda.

The subsector study framework provides a pragmatic approach for identifying problems in a systems context. It is particularly useful in situations where major political, economic and technological forces are changing food systems. For this reason I am suggesting that this approach may be useful in China. The sub-sector study methodology has been developed and used in market oriented economies, but in all instances there have been significant public sector involvements in administering food system policies and programs. This has been particularly true in Latin American and African countries where governments have taken an active role in regulating and facilitating food system development. It should be recognized that the public sector always has an important role in establishing policies to guide and regulate market processes and to provide a major portion of the investment capital for marketing infrastructure. These public sector initiatives are an important force in encouraging private sector investments and overall market system development (Shaffer, 1987).

I will use the term "subsector" to mean essentially the same as "commodity system." The "subsector" is a vertically linked set of participants that produce, process and distribute a particular commodity or closely related set of commodities, e.g., grains, fruits, vegetables, pork, eggs, milk. Participants in the subsector will include input suppliers, farmers, assemblers, processors, wholesalers and retailers, and consumers.

The subsector study approach focuses on the coordination process among the various stages in commodity systems. Emphasis is on the review of alternative institutional arrangements that facilitate needed physical transformations and exchange functions. The descriptive-diagnostic investigations attempt to identify problems with the existing coordination arrangements and opportunities to improve performance of the system by aligning the production-distribution processes with new product markets and by increasing efficiency. The diagnosis should identify constraints to improved

performance and prescribe policies and programs to overcome these constraints giving attention to interrelationships among the various stages within the system.

The desired performance attributes may vary among commodities but a suggested list that we have found useful includes the following:

1. The matching of supply and demand at each stage in the production-distribution system.
2. Efficiency in carrying out the physical transformation, handling and delivery of commodities as well as in arranging and carrying out transactions.
3. Progressiveness in developing and adopting more productive technologies, management methods and institutional arrangements.
4. Equity in returns to subsector participants in relation to value added to the final product, costs and risks incurred. Equity can also include access to markets, information and support services such as credit.

It should be apparent that there are potential conflicts among the performance attributes which must be taken into consideration in designing new policies and programs, e.g. equity goals may conflict with progressiveness and efficiency goals.

The evaluation of subsector performance must be supported by gathering and organizing data and information in three main categories.

Basic conditions--

Commodity characteristics

Calendar of production, processing and distribution

Geographic location of production and consumption

Consumption patterns

Price relationships over time and space

Geographic movement of products

Trends, projections and forces of change

### Subsector Organization

- Stages in the production-distribution process
- Institutional organization and types of participants
- Relative importance of market channels
- Physical infrastructure
- Changing structure of the subsector and the forces of change

### Coordination Processes

- Planning and strategizing
- Transaction procedures
- Information flows
- Government programs, regulations and support services

Although there is a need for accurate descriptions of basic conditions, subsector organization and coordination processes, it should be guided by a purposeful diagnostic perspective. This can reflect the search for problems and opportunities linked to established performance goals. The actual conditions and perceived problems of market participants, such as farmers, managers, and workers engaged in processing, wholesaling, retailing and government officials, are important inputs into a subsector study.

On the basis of our food system field research experience in Latin American countries and more recently in African countries, we have developed a modified two-stage approach to conducting subsector studies in situations where there is an urgent need for some preliminary guidance on important food marketing policy decisions. The first stage is what we now refer to as a "rapid reconnaissance" technique. This activity is designed to be carried out by a small team of two to five people over a period of one to three months. Ideally, the team should include professionals with different backgrounds and skills, e.g., an agricultural economist, an agribusiness management specialist, a post-harvest technologist, and/or an institutional analyst. The scope of the

reconnaissance will often need to be limited to a particular geographic area, e.g., a major urban market and the rural area from which it draws its supplies of the commodities being investigated.

The study would be designed and carried out within the general food system subsector framework described earlier. However, emphasis would be on the following:

1. A quick assessment of previous studies and readily available data on prices, supplies and market conditions.
2. Direct observations of food system facilities and operations relevant to the selected commodity.
3. Informal, in-depth interviewing of a carefully selected, small number of commodity system participants, including some knowledgeable observers and recognized organization leaders.

This type of informal interviewing requires skilled individuals equipped with a basic set of leading questions to be followed by more probing questions as the interview proceeds. Different team members will have questions related to their area of responsibility and expertise. If carefully done, the "rapid reconnaissance" will provide useful, current and reasonably reliable assessments of actual market operations, the problems as perceived by participants at different stages in the production-distribution process, the opportunities for changes in policies, institutional arrangements or for new investments in facilities and technology. We have published a handbook (Holtzman, 1986) which elaborates a set of guidelines for this type of investigation. The potential misuse of the rapid reconnaissance technique is recognized since the results are based upon a relatively small amount of information. Nevertheless, if carefully carried out the technique will satisfy some of the needs of decision-makers and can serve as the basis for designing a more comprehensive and reliable subsector assessment with well-reasoned prescriptions for market improvements. In some instances the quick assessment will

identify potential pilot project activities where new ideas can be tested and further developed before recommending widespread adoption.

### **Applications of Food System - Subsector Study Methodologies**

During the late 1960s and early 1970s, a team of Michigan State University researchers undertook food marketing studies in four Latin American countries (Brazil, Colombia, Bolivia and Costa Rica). In each country the studies were planned and carried out in collaboration with local institutions with substantial participation of their personnel. The primary objectives of the studies were (1) to diagnose food system organization and coordination problems; (2) to design medium to long-term strategies for improving marketing performance; and (3) to formulate a comprehensive, integrated set of recommendations for market system reforms. A secondary objective was to expand our knowledge and understanding of the dynamic role of market processes in economic development.

I will now turn to a brief summary of some of the experiences in Colombia, South America, a country where I have field experience extending over a period of twenty-five years and including actual residence in the country for two assignments of two years each and numerous shorter visits. For a more complete report on our Latin American food marketing studies, I refer you to a summary publication by Harrison, et al, 1974.

The initial studies in Colombia were focused on the Cauca Valley Region, a very productive agricultural area with a high population growth rate and a rapidly growing urban population. The dominant urban-industrial center in the region was Cali with one million inhabitants and annual growth rate of six percent.

The most pressing food marketing problem confronting local authorities was the eradication of an antiquated, highly congested and socially undesirable food marketing complex located in the center of the city. The perceived solution by local political leaders was to construct a new physical facility at a more acceptable location and to transfer the existing wholesale-retail operation to the new facility.

In our preliminary discussions with local officials and with the participation of professionals from local institutions we evolved a research plan of work designed to assess future marketing facility needs, taking into consideration the major forces of change in consumer demand, agricultural and urban development. The urban study components included systematic surveys of urban households, food wholesalers and retailers. The rural study components were commodity subsector studies for five commodity groups: (1) fruits and vegetables; (2) grain; (3) red meats; (4) milk; (5) poultry and eggs. Surveys were carried out at the farm, assembly and processing levels for each commodity and linked with the urban food distribution study results.

In addition, we conducted special studies of technical farm input distribution, transportation, laws and regulations, information and communication, and credit availability for food production and marketing. We also investigated the constraints for expanded employment opportunities in residential construction and in the manufacture and sale of non-food consumer goods. The latter studies were in anticipation that recommendations for modernizing the food marketing system might require some marginal shifting of an expanding labor force from agricultural and food distribution jobs to industrial and service based industries.

Within a period of one year our research team prepared 16 technical reports and a draft summary report for local policy makers and leaders within the Cauca Valley food system. The reports included descriptive-diagnostic assessments and a set of proposed actions to improve food system performance. The results of the studies were discussed with local leaders prior to the preparation of a revised, final report (Riley, et al, 1970). Follow up assistance was provided for the more detailed development of planned market facility investments, especially a central wholesale food market primarily for perishable commodities. A major outcome of the studies was to promote the adoption of a more comprehensive, systems approach to the development of planned reforms in food marketing. Very important in the process was the increased realization that market

facility investments should be carefully conceived so that complementary institutional and technological changes were taken into consideration and in the context of a desired longer-term pattern of development.

Immediately following the food marketing studies in Cali, Colombia, a similar study was undertaken by a newly created public sector food marketing institution (CORABASTOS) in Bogota, the capital city of Colombia. Many of the Colombian professionals who participated in the Cali studies were engaged to carry out the Bogota studies. CORABASTOS moved rapidly into an action program that included the construction of a new wholesale market and the organization of related programs to improve food retailing within the city and the development of coordinated systems of commodity assembly and delivery to the new central market.

Concurrently with the planned construction of Bogota's new wholesale market, the Federation of Coffee Growers initiated a program to encourage farmer members to shift some of their land into fruit and vegetable production as a means of adjusting coffee output to potential world markets and as a means of responding to growing urban demands for fruits and vegetables. Increasing employment and incomes of farmers were also important goals. Our University staff was invited to provide technical advice to their program development unit. It was decided that a limited set of pilot activities would be undertaken to help develop production and marketing capabilities for selected fruits and vegetables. This included the establishment of a market information service and rudimentary assembly centers for grading, packaging and transshipment to the Bogota market. Meanwhile, arrangements were made for an MSU doctoral student to conduct a detailed study of the possibilities for the development of an enlarged fruit and vegetable production-assembly activity that would link a selected coffee producing zone with the new Bogota wholesale market. The study included a careful feasibility study to guide potential investments in assembly centers within the production zone. The results of this study and the experience with pilot projects provided useful guidance to the Coffee Federation Diversification Program. Among other things it convinced them that the

production and marketing of perishable fruits and vegetables was more difficult and involved greater risks as compared to the well-established coffee production and marketing program.

Our more recent field experience with commodity sub-system studies is taking place in five African countries under a project funded by the U.S. Agency for International Development. The main focus of the work is to assist these countries in their efforts to achieve greater food security for their rapidly growing populations. The emphasis is on improving the performance of the food grain production and distribution systems through coordinated changes in policies, institutions and technology. In all countries there are significant efforts underway to strengthen the role of markets, to identify effective incentives for farmers and merchants to invest in new activities, and to modify the government's direct interventions in market operations.

#### A Suggested Set of Research Questions

Based upon our experience in several countries, I will sketch out a list of research questions that may be relevant to the planning and guidance of a more market oriented Chinese food system.

1. What has been the pattern of consumer response to changing prices and availabilities of major food commodities? What are the demand projections for selected commodities in major urban centers and in rural areas?
2. What has been the farm level response to more flexible prices and new market channel opportunities? How does the response vary among regions and among commodities?
3. What changes have occurred in the flow of food commodities through different market channels and what have been the relative costs?
4. What are the likely changes in the location of agricultural commodity production in response to the new marketing policies?

5. What are the perceived impacts of the marketing changes as seen by farmers, private traders, market administrators and government officials? What constraints need to be addressed and what suggestions do market participants have for improving market performance in the context of the Chinese socialist system?
6. What are the different mechanisms for establishing prices and coordinating the flow of products from farms through assembly, wholesale and retail market channels?
7. How can marketing and supply cooperatives be reorganized to be cost-effective and progressive components of the food system?
8. What public sector facilitating services and investments are needed to assist subsector participants in undertaking new activities that would improve food system performance?
9. What are the potential costs and benefits of alternative investments and institutional arrangements for assembling, processing and distributing food commodities? How should these be combined into medium to long-term food system development plans?

### Concluding Remarks

All food systems must perform certain basic functions which become more complex and more costly during the process of economic development. Each country has the opportunity to promote and guide the development of their food marketing system so as to achieve their own social and economic goals. In China there is an immense challenge to effectively design policies and institutions to modernize the food system within the existing socialist political-economic framework. I have suggested some procedures that have been useful in diagnosing opportunities for improvements in food commodity systems in other countries. This is a flexible methodology that can be adapted and used in the planning and management of food systems within different political environments.

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