Value-Added Research as a State Economic Development Strategy*

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The major agricultural producing states have long been interested in boosting exports of agricultural commodities. As a major component of the economic base in farming regions, state agricultural exports provide the earning power to support services and related agricultural industries. The final destination for these exports can be markets either in other states or in other countries.

States are interested in not only the volume but also the value-added composition of agricultural exports. Growth in markets for bulk agricultural products provides direct benefits to producers in the form of higher farm prices and increased employment in the input and marketing sectors. Growth in the demand for value-added agricultural products, however, expands the economic impact of exports beyond that of bulk commodities by employing additional resources in a variety of different productive activities. Value-added commodities are generally classified as either semi-processed or highly-processed food products (Table 1). High-value, unprocessed commodities such as fruits and vegetables, are often included as a third category. From the state's perspective, larger export volumes


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Table 1. Classification of High Value Agricultural Products

A. Semiprocessed products.
   Included are: fresh, chilled, and frozen meat, wheat flour, refined sugar, coffee, cocoa, tea, animal feeds, oilseed cake and meal, animal oils and fats, and vegetable oil.

B. Highly processed products.
   Included are: prepared and preserved meats, milk, butter, cheese, cereal preparations, dried fruit, preserved/prepared fruit, preserved/prepared vegetables, nonchocolate sugar preparations, chocolate, spices, miscellaneous food preparations, beverages, and cigarettes.

C. High-value unprocessed products.
   Included are: eggs, fresh fruits and nuts, and fresh vegetables.

D. All other products are classified as low-value products (LVP's).


of high-value products mean higher levels of employment and income in the state. Table 2 clearly illustrates that the higher the level of processing associated with a commodity, the greater is the number of jobs that are added to the state's economy. Consequently, many agricultural-based states have become increasingly interested in developing and exploiting value-added industries in agriculture as a means of fostering economic development.

A major component of this development strategy in many states has been investments in research to boost the production and marketing of value-added agricultural products. These investments include the recent funding of value-added research centers at land-grant institutions such as the International Marketing Program for Agricultural Commodities and Trade
Table 2. Economic Activity Generated in Exporting Selected Farm Products

<table>
<thead>
<tr>
<th>Tons</th>
<th>Value of 1,000 Tons of Feedstuff Expressed as:</th>
<th>Employment Required to Export 1000 Tons of Feedstuffs as:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feedstuffs</td>
<td>1000</td>
<td>434,150</td>
</tr>
<tr>
<td>Corn</td>
<td>720</td>
<td>157,700</td>
</tr>
<tr>
<td>Soybean Meal</td>
<td>280</td>
<td>276,450</td>
</tr>
<tr>
<td>Soybeans</td>
<td>390</td>
<td>202,800</td>
</tr>
<tr>
<td>Poultry</td>
<td>335</td>
<td>825,000</td>
</tr>
<tr>
<td>Pork</td>
<td>250</td>
<td>1,200,000</td>
</tr>
<tr>
<td>Packaged Meat</td>
<td>300</td>
<td>1,750,000</td>
</tr>
<tr>
<td>Processed Foods</td>
<td>600</td>
<td>1,350,000</td>
</tr>
</tbody>
</table>


Center at Washington State University, the Meat Export Research Center and the Food Crops Processing Research Center at Iowa State University, the Food Protein Research and Development Center and the Texas Agricultural Market Research and Development Center at Texas A&M University, the International Feed and Food Grain Institute and the International Livestock Center at Kansas State University, and the Food Processing Center at the University of Nebraska to name just a few. Other states, including New York, Indiana, Pennsylvania, and Illinois, are in the process of initiating or building their research programs within the land-grant university system in the value-added area.
Value-added research can be defined as research associated with any value-added commodity or activity. Added value is a form of wealth but not all forms of wealth are added value. Natural resources are wealth provided by nature. Value is added to this wealth by the efforts and ingenuity of mankind. Traditional agricultural research has focused primarily on the value-adding activities of farmers in utilizing seeds, fertilizer, fuel, machinery, and other farm-level inputs to raise and market crops and livestock. Typically, however, value-added activities are defined as those occurring after the commodity leaves the farm gate. Under the federal Cooperative Research Information System (CRIS) for reporting Experiment Station research, value-added research would fall primarily under Research Problem Areas (RPA) 400 through 704 (Table 3). The RPAs cover the range of value-added activities involved in moving raw agricultural products from the farm to consumer markets.

Most value-added research activities can be classified into one of the following two categories:

1) research to help firms begin and become more efficient at producing and marketing value-added products for which well-established markets already exist; and

2) research to develop and market new value-added commodities for new markets or as substitutes/complements to products already on the market (e.g., corn sweeteners replacing sugar).

The next two sections discuss the relationship between research in these two areas and state economic growth. The role of economists in value-added research is then considered. The paper concludes with some observations for policymakers and research administrators.
Table 3. Research Problem Areas (RPA) Involving Value-Added Research

GOAL IV: EXPAND THE DEMAND FOR FARM AND FOREST PRODUCTS BY DEVELOPING NEW AND IMPROVED PRODUCTS AND PROCESSES AND ENHANCING PRODUCT QUALITY

401 New and Improved Forest Products
402 Production of Fruit and Vegetable Crops with Improved Acceptability
403 New and Improved Fruit and Vegetable Products and By-products
404 Quality Maintenance in Storing and Marketing Fruits and Vegetables
405 Production of Field Crops with Improved Acceptability
406 New and Improved Food Products from Field Crops
407 New and Improved Feed, Textile, and Industrial Products from Field Crops
408 Quality Maintenance in Storing and Marketing Field Crops
409 Production of Animal Products with Improved Acceptability
410 New and Improved Meat, Milk, Eggs, and Other Animal Food Products
411 New and Improved Nonfood Animal Products
412 Quality Maintenance in Marketing Animal Products

GOAL V: IMPROVE EFFICIENCY IN THE MARKETING SYSTEM

501 Improvement of Grades and Standards - Crop and Animal Products
502 Development of Markets and Efficient Marketing of Timber and Related Products
503 Efficiency in Marketing Agricultural Products and Production
506 Supply, Demand and Price Analysis -- Crop and Animal Products
507 Competitive Interrelationships in Agriculture
508 Development of Domestic Markets for Farm Products
509 Performance of Marketing Systems
510 Group Action and Market Power
511 Improvement in Agricultural Statistics
512 Improvement of Grades and Standards of Forest Products
513 Supply, Demand and Price Analysis -- Forest Products

GOAL VI: EXPAND EXPORT MARKETS AND ASSIST DEVELOPING NATIONS

601 Foreign Market Development
602 Evaluation of Foreign Food Aid Programs
603 Technical Assistance to Developing Countries
604 Product Development and Marketing for Foreign Markets

GOAL VII: PROTECT CONSUMER HEALTH AND IMPROVE NUTRITION AND WELL-BEING OF THE AMERICAN PEOPLE

701 Insure Food Products Free of Toxic Residues from Agricultural Sources
702 Protect Food and Feed Supplies from Harmful Micro-organisms and Naturally Occurring Toxins
703 Food Choices, Habits and Consumption
704 Home and Commercial Food Service
Value-Added Research and Efficiency

To increase a state's share of value-added activities in products for which markets already exist, such as meat packing or grain processing and milling, it is usually necessary for the firms in the state to gain and maintain a competitive cost advantage. Research investments in the development of new or more efficient processing technologies and transferring them to in-state firms would increase the volume and enhance the competitiveness of the processing activity in the state. Technical research could focus on improving efficiencies at each stage in a value-added commodity firm's operations, including assembling the raw inputs, processing, and marketing the intermediate or final products. Research investments could also be made to help identify optimal locations and the economic feasibility of capital subsidies for relocating or expanding firms with value-added products.

There are risks to states involved in the strategy of competing for a larger share of an existing market. Since most of the major Midwest agricultural commodities are homogeneous, state-funded research has applicability across a wide section of the country, not just for the state funding the research. The transferability of the research across state lines raises questions concerning the role of state-level funding of research where the benefits can be appropriated by nonfunding states. Another concern for state economic development efforts is that many types of agricultural processing are highly capital intensive so that the employment gains from this strategy may be small.
New Product Research

Value-added agricultural research is most often thought of as research to develop new products of higher value from lower-value raw or traditionally-produced commodities. The idea is that the value of many raw commodities that are traditionally produced and sold can be enhanced by altering their form, size, composition, appearance, texture, or other physical attributes. Other raw products can be decomposed into their various chemical components to be recombined with other ingredients to produce new products of potentially higher value. The successful development of a new product provides the potential for developing and expanding the productive activity in the state and helping to promote overall economic development. There is a promise not only of expanding jobs and economic returns for the state in the production, marketing, and distribution of the new product but also of strengthening traditional economic activity in the state by providing new markets for raw commodities.

It is possible, of course, that new product research of this type may accomplish little more than support the lifestyle of researchers at state-supported institutions. Whether or not the research actually leads to the desired economic outcomes depends crucially on a number of factors, including the following:

1. The efficiency of any existing mechanism for technology transfer from the public to the private sector;
2. The transferability of the new product technology to the private sector, i.e., the technical adaptability of the process for commercial use;
3. The existence of a market for the new product at the price necessary to cover costs and provide an acceptable return on the investment; and

4. The ability of the private sector of the state to capture and retain the returns (or value-added) from the new product research.

The most well-known agricultural technology transfer mechanism is operated by the Cooperative Extension Service (CES) which is comprised of state extension services and the U.S. Department of Agriculture Extension Service in affiliation with land-grant colleges and their associated experiment stations. Traditionally, however, the CES system has focused few resources on creating or enhancing value-added beyond the farm gate. Unless an efficient mechanism exists in the state to transfer new, value-adding processes and technologies from the state-supported institutions where the research occurs to the private, food processing industry where it will be applied, much of the value-added research investments could be wasted. Such a mechanism would draw the food industry and universities into the type of successful working alliance that has characterized the CES system at the farm level. The research necessary to develop and apply an appropriate mechanism is no less important than the new product research itself.

Most often the processes required to produce new products are developed under laboratory conditions and must be adapted if possible to the workplace environment. Too often, however, too few research resources are dedicated to developing efficient, cost-effective means to commercialize the new technologies. The consequence, again, is that much
otherwise promising research might never lead to an increase in the value of agricultural products.

It is important to understand that the measure of value-added is not the effort that has gone into the activity. Added value is determined by the satisfaction of the customer, not by the work of the producer. Developing and producing a meat product with an unusual texture, for example, might require considerable effort on the part of the researchers and the workers and managers of some meat fabricating company. But if no one wants to buy such a product, no added value has been generated. Often, however, researchers proceed with new product development based only on the general principle that new products add value to the raw commodity and assume that commercialization of the process and product will result in new jobs and income in the state. New product development research must go hand in hand with technical and economic feasibility studies to determine the potential commercial production costs and sales. It is not enough, however, to determine that a market for the new product exists. There must be a market for the product at a price which will yield a sufficient return over costs. Effective market research can often precede and help guide new product development. By analyzing food consumer behavior and markets around the world, market research can provide some guidance to scientists in their efforts to develop marketable value-added food products that fit into traditional food consumption patterns.

A major problem for a state in supporting such value-added research is ensuring that the returns from their research investments can be captured and retained. If the new product technology is readily accessible or easily duplicated, for example, firms in other states could quickly compete
away any economic rents that might exist. This is particularly the case for national companies with offices in various regions of the country. Working with small and medium-sized companies in the state may offer the best potential for maintaining the value-added from the research investments. Some characteristics of new products from which the value-added in research can be most easily captured include:

1. the labor skill required to produce the product is unique and not easily learned;
2. the economies in the research, handling, and marketing of the product are difficult to duplicate elsewhere;
3. the product is identified closely with the state in terms of quality and availability; and
4. the technology is "protected" in some way as to be relatively unavailable to potential competitors.

The Role of Economists

To achieve economic growth, value-added research must go far beyond the laboratory and follow the new product along its path to the final consumer. This requires a multi-disciplinary team of animal and crop scientists, food chemists, microbiologists, and other food scientists and technologists, nutritionists, agricultural engineers, economists, marketing specialists, sociologists, and others working together on the various interrelated stages of the research process. Not all of the research efforts of such teams, however, will yield new economic growth for the state. Precisely because only a small percent of all value-added research
can be expected to yield significant new economic activity in a state, a large percentage of such research is publicly funded.

The economist on the team can help guide the research in directions that are more economically feasible by conducting benefit/cost analyses of alternative value-added research investments. Once the research investments are made, the economist can help ease the technology transfer process by providing benefit/cost analyses of value-added production investments. Unfortunately, however, scientists rarely consult economists before developing their research agendas. By first conducting research to analyze the market potential of alternative new value-added products, scientists could minimize the amount of time wasted in developing interesting products with unique properties that no one can use or wants to buy.

Traditional market research includes economic analyses of numerous economic indicators such as income, inflation, and employment as well as trends in commodity supply, demand, prices, trade, and policies in given countries. To successfully assist in capturing value-added for any given state, however, market research must move "downstream" and provide producers of value-added products in the state with much more detailed information about the markets for the specific commodities they want to produce and market. This includes information and analyses on specific government regulations relevant to the value-added product, transportation methods and costs, distribution channels, consumer preferences and customs, alternative marketing strategies, the behavior of firms producing similar or complementary products, and more.

The development of new agricultural products can lead to difficult policy issues that require detailed economic analysis. The growth of the
corn and artificial sweetener industry, for example, has complicated policy decisions with regard to sugar price supports. Economic research is also needed to analyze the potential impacts of the new products on the markets for substitute and complementary commodities and the related policy issues that arise.

Some Observations for Policymakers and Research Administrators

Investments in value-added research are a tremendous potential catalyst for state economic growth. The important question for policymakers is how to ensure that the investments will pay-off. For research administrators the key problem is developing a research agenda that maximizes the returns to investments in value-added research. In developing such an agenda, the following observations may be useful.

First, the research agenda must extend far beyond product or process development and bridge the gap between the research laboratory and the consumer table. This includes research to develop and maintain a technology transfer mechanism, research to commercialize new processes and technologies, research to determine the size, growth, and location of markets for newly developed value-added products, economic and technical research investment feasibility studies, and more.

Second, much of the research required to ensure the economic success of new product and process development is not that which is traditionally done at state-supported institutions. How much of this research should be done in the public sector and how much in the private sector? Also, university researchers are usually rewarded based on the number of publications flowing from their research. How will researchers that must conduct
necessary but unpublishable research (such as research to discover markets and develop marketing strategies for new products) be rewarded?

Third, allocations of research funds among the areas included on the agenda should reflect the relative likelihood of a state economic development pay-off. This may require some study of the economic and technical feasibility of the research on the agenda before significant funds are committed to the various promising projects.

Fourth, it may be difficult to capture the value-added from research on raw commodities like corn or soybeans that are widely produced and available. This suggests that the primary research focus should be on adding value to commodities in which the state has a particular competitive advantage. Such an advantage could arise from agroclimatic conditions, tax laws, the proximity of markets, or other factors that make production of the commodity relatively more difficult and costly elsewhere. One alternative could be for a number of states that are potential beneficiaries of value-added research of this type to fund such research or to seek federal support jointly.

Finally, the existing institutions regarding proprietary research and patent rights at state-supported universities need to be reviewed. Restricting researchers in some way from participating in the returns flowing from new product process and technology discoveries may amount to a disincentive to conduct needed value-added research. Also, some attention needs to be given to reconciling the conflicting interests of the public orientation of land-grant universities and the proprietary concerns of private firms when undertaking joint research.