Asset Mapping: A Useful Methodology to Plan Systematically Extension Programs for Sustainable Rural Economic Development

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Abstract

The main objective of this paper is to describe and empirically demonstrate the use of Geographic Information Systems (GIS) tools in an innovative asset-mapping methodology. GIS asset-mapping methods and tools can help extension personnel in program planning and in assisting farmers in determining comparative advantage for different value-added products within their respective communities. This type of analysis allows farmers and agricultural leaders to see the “big picture” with respect to their strategic assets as they consider whether to pursue value-added opportunities and work toward sustainable rural economic development.

The primary and secondary data presented in this paper were collected and compiled during 1998-2001 to create a GIS spatial database for use in asset-mapping. Two types of findings are presented. First, exogenous and endogenous assets, pertaining to value-enhanced farm products in different Illinois eco-regions, are identified and selected examples illustrated. Endogenous assets included factors such as farmers’ skills, resources, and willingness to join and/or invest in value-added endeavors. Exogenous factors included domestic and international markets, natural resources and infrastructure. Second, using these GIS tools, strategic assets can be displayed through a series of layered spatial outputs that can be scaled to county, eco-region, and/or state levels of analysis.
Introduction

Given the advent of trade liberalization, globalization and, in particular, the rapid expansion of soybeans and corn production in the Brazilian cerrado, world commodity prices for these two important Illinois crops have steadily fallen. Declining farm income is severely threatening rural communities throughout Illinois and the Midwestern United States. As a result, in September 1998, the University of Illinois initiated a new research-extension project that would examine how Illinois farmers might become more competitive within the global economy and, thereby, contribute to sustainable rural economic development.

The overall goal of the Value Project1 is to find effective ways for Illinois farmers to participate in expanding markets for value-enhanced crops and livestock, as well as to explore opportunities for them to move up the value chain by investing in value-added processing. The project is organized around five major components: value-enhanced crop marketing, value-enhanced crop technology, specialty livestock, group action (horizontal and vertical integration), and the Illinois Farm Survey.

As documented elsewhere (Swanson, et. al., 2001), the production and marketing of value-enhanced farm products is a relatively new strategy that Illinois farmers are pursuing to capture additional value for their farm products. Increasing numbers of commercial farmers are turning to the production of more specialized farm products. In addition, new crop hybrids and varieties are being developed with specific traits that can be produced and marketed to end use processors. In addition, high income, well-educated consumers are demanding a broader array of products with specific traits. As a result, Illinois farmers are beginning to realize that they can reap higher profits by producing value-enhanced crops for these emerging "differentiated" markets.

Addressing issues of markets, profitability and farmer experience, as well as assessing farmer interest in and knowledge about value-enhanced farm products became a priority research concern. It was apparent early in the project that if value-enhanced crop production was to expand beyond the relatively small group of innovative farmers, who were already producing these crops, then a new, more comprehensive research-extension initiative would have to be developed. Therefore, the decision was made to integrate the output from the five primary project components through an innovative application of asset-mapping methodology, within a strategic planning framework, using Geographic Information Systems (GIS) tools.

Objectives

The main purpose of this paper is to describe and illustrate the application of the asset mapping methodology to plan and deliver value-added extension programs for sustainable rural economic development. The first objective is to present the conceptual framework developed by the Value Project to analyze strategic assets that affect the production and marketing of value-enhanced commodities in Illinois. The second objective is to demonstrate the use of GIS tools in spatially analyzing selected strategic assets. This information can be used by Extension in both program planning and in communicating findings to farmers. Also, by presenting a series of “layered” visual representations of different strategic assets at different levels of analysis, can help reveal complex relationships that affect value-added agriculture and, thereby, better inform farmer decision-making.
Research Methodology and Data Sources

Both primary and secondary data were used in implementing this approach. The primary data source is from the Illinois Farmer Survey, which was initially conducted on a pilot basis in five counties from December 1998 through March 1999 and included 3,100 farmers. The remainder of approximately 70,000 farmers in 102 Illinois counties was surveyed between December 1999 and March 2001. Data collection was carried out through the use of a written survey that was mailed to all active farmers in each county by the local Extension office. Response rates varied by county but by June 2001 over 11,079 usable questionnaires had been returned and processed. The final number of useable survey instruments represents 15.7% of the total number of active farmers in the state who control 31.6% of the state’s 24 million acres of cropland.

Two other primary data sources were used in this paper. The first is from three annual surveys of Illinois Grain Handlers that were carried out in January of 1999, 2000, and 2001. First, a comprehensive telephone survey of 1,100 elevators or grain merchants was carried out in January 1999, with responses from approximately 95% of all grain handlers in the state. This initial survey was repeated in January 2000, and 2001, using a written questionnaire that asked only about the type of value-enhanced crops being handled and premiums being offered. The other source of primary data was from the on-farm trial program carried out in 1999, 2000, and 2001. This research provided performance and profitability data on different value-enhanced corn and soybean varieties in the three major Illinois’ regions (northern, central and southern). Some secondary data from the Illinois Agricultural Statistical Service, for the years 1991-2000, were used to create crop yield performance and variability maps.

Analytical Framework and Tools

The analytical framework used in this research is based on SWOT analysis (strengths, weaknesses, opportunities and threats) that is commonly used in strategic planning. Two types of assets were examined. Endogenous assets included factors such as farmers’ skills, resources (size of farm, grain storage, drying facilities, etc.) and their willingness to join and/or invest in value-added endeavors. Exogenous factors included domestic and international markets, natural resources (soils, growing season, rainfall, etc.) and transportation infrastructure (rail, road, water).

The first part of the SWOT analysis was used to identify the most important strengths and weaknesses in each eco-region of the state with respect to value-enhanced crop and livestock production. In general, we refer to these strengths as “strategic assets.” These factors include producers’ skills, agronomic conditions, proximity to existing markets, transportation infrastructure and on-farm resources. Weaknesses, on the other hand, may be the absence of specific assets or the presence of certain unfavorable conditions, such as significant yield variability from one year to another. These factors are considered as “strategic liabilities.” Strengths and weaknesses of an eco-region will be the primary focus of this paper. The second part of the analysis examines strategic opportunities and threats to current and potential value-enhanced markets. This broader focus will be a primary research thrust during the next two years of the project.

Geographic Information Systems (GIS) tools are used to collect, store, retrieve, and display spatial data on regional assets and their relationships. GIS tools allow for visualizing and reporting data in a spatial format that informs decision-making. An important feature of
GIS is its ability to organize different types of data into layers. This ability permits stacking of data on top of a ‘base map’ in layers so that information can be seen in relation to regional characteristics. These layers can be analyzed in isolation or cross-referenced and analyzed together.

**Findings**

Due to space limitations, only a few selected assets, that affect value-enhanced crop production and marketing, will be described and illustrated in this section. The first section will summarize some of the important exogenous assets included in our GIS database and then selected endogenous assets will be analyzed.

**Exogenous Assets**

- **Domestic Markets.** In the case of grain, these markets are local grain elevators (both cooperative and private firms) that serve as the primary market for different types of value-enhanced corn and soybeans. They are the delivery point for most farmers. As noted earlier, the research team conducts an annual survey to identify those firms that handle value-enhanced crops. This information is then geo-coded and displayed on the project’s web site as a searchable database so farmers can identify those firms and facilities in their area that handle different value-enhanced crops (Example not shown). On the project’s web site (http://web.aces.uiuc.edu/value/), each type of value-enhanced corn and soybeans is displayed separately to facilitate communications.

- **International Markets.** Illinois exports about 50% of its corn and soybean production; therefore, international markets are of strategic importance to the state’s agricultural economy. During the next two years, the research team will concentrate on identifying these new opportunities for value-enhanced corn and soybeans.

- **Natural Resources.** Illinois lies in the heart of the U.S. Corn Belt and nearly two-thirds of the state is endowed with deep, fertile, and well-drained prairie soils. Soil survey maps are available that document the different soil types and productivity indexes for each area of the state, down to the individual farm level of analysis. Figure 1 displays the yield performance for corn in different parts of the state, and figure 2 illustrates the significant differences in yield variability across the state, which reflects, in large part, a combination of rainfall patterns and the water holding capacity of the soil. Yield variability (or stability) is very important when growing value-enhanced crops under contract.
• **Current Production of Value-Enhanced Crops.** Some types of value-enhanced crops, such as food-grade corn and soybeans, have been grown in Illinois for two or more decades. In other cases, local or international grain traders know that a specific area of the state is well suited for producing a particularly value-enhanced crop, such as clear hilum soybeans for tofu, and have contracted with local growers to produce specific varieties of this crop. By examining the current production areas for different value-enhanced crops, it is possible to identify those eco-regions of the state that appear best suited for different crops. The scope and location of clear hilum soybean production is illustrated in figure 3 below.

• **Profitability of Different Value-enhanced Crops.** To objectively determine the profitability of different value-enhanced crops in each eco-region of the state, the Value Project has organized an on-farm research program. Figure 3 illustrates the yield performance and profitability of clear hilum soybeans in the major agronomic regions of the state. The yield and relative profitability of this value-enhanced crop is compared with the performance of several conventional, but elite varieties of the same crop. This information, juxtaposed against the map showing the major production areas for clear hilum soybeans, is valuable to farmers in deciding whether it would be more profitable for them to produce this value-enhanced crop. The research team has comparable yield, profitability, and production data for all value-enhanced crops currently grown in Illinois.

• **Transportation Infrastructure.** The availability and cost of different modes of transportation are major factors affecting the relative profitability of different value-enhanced crops. The Illinois, Mississippi, and Ohio Rivers are the primary reasons why Illinois exports about one-half of its corn and soybeans. In addition, an extensive rail system provides low cost access to major domestic markets as well as some international ports. Therefore, access and proximity to key transportation terminals becomes a critical factor in determining whether farmers in a particular eco-region have a comparative advantage in profitably producing and marketing a specific value-enhanced crop (Example not shown).
Endogenous Assets

- **On-farm Resources.** Resource variables in the study included: a) size of farm, b) on-farm storage capacity, and c) the availability of low temperature drying facilities. In analyzing these data, we found a strong positive correlation between size of farm and volume of on-farm storage, as independent variables, and interest in or current involvement in value-enhanced crop production as a dependent variable. Larger farmers were more likely to produce value-enhanced crops than their low-resource neighbors. In addition, age and years of education are also significantly associated with value-enhanced crop production. Due to space limitations, none of these findings could be shown.

- **Farmer’s Technical and Managerial Skills.** It is difficult to accurately assess these types of variables. However, we statistically tested the possible relationship between the two independent variables, age and years of education, and the dependent variable: interest and/or involvement in value-enhanced crop production. As expected, younger farmers with more education were more likely to become involved or to express an interest in producing value-enhanced crops.

- **Human Capital.** Another factor affecting farmer’s technical and managerial skills regarding value-enhanced crop production are the number of value-enhanced crop producers in individual counties or eco-regions of the state. This factor could be considered as a general measure of human resource capacity or human capital associated with value-enhanced crop production in different areas of the state. It is assumed that counties or eco-regions that have a higher percentage of value-enhanced crop producers would have a higher level of human resource capacity to pursue different types of value-enhanced crop production in the future. As shown in Figure 4 below, the percentage of value-enhanced crop producers varies between 5% and 43% across different counties in the state. This information could be useful to Extension when targeting farmers in different areas of the state to organize a marketing alliance.
• **Farmer Willingness to Join Farmer Organizations.** Another hypothesis guiding this research was the expectation that if farmers are to capture more of the value from value-enhanced farm products they would need to organize into some type of marketing alliance or cooperatives. The experience of farmers who have produced value-enhanced crops in the past is that as soon as a new crop is found to be successful, other farmers begin producing the crop, thereby increasing the supply and driving down prices, premiums, and profits. Therefore, a working hypothesis was that one way of avoiding or slowing this “value decay” would be for farmers to get organized to reduce transaction costs, capture economies of scale, and increase market power. As show in Figure 5 above, there are important differences across the state regarding the willingness of farmers to join some type of producer’s alliance.

• **Willingness to Invest in Value-Added Processing.** Many farmers believe that if they could “move up the value chain,” by owning and operating their own agro-processing firm, they would capture more value from their crops. Therefore, farmers who were interested in or already producing some type of specialty farm product were asked whether they would consider investing in a “farmer owned” value-added processing facility. If they would consider getting involved, then they were asked how much money they would be prepared to invest, given the right to deliver a specified quantity of their farm output to the plant. There were substantial differences across counties and eco-regions regarding the willingness of farmers to invest in value-added processing (Example not shown).

**Integration and Use of GIS Information in Determining Comparative Advantage**

After generating these different types of spatial analysis, the next step is using this information in the strategic planning process. This process must involve agricultural leaders; farmers who are interested in value-added agriculture; agribusiness representatives, especially farm cooperative managers that supply farm inputs and handle value-enhanced grain; and other community leaders. The primary objective of going through this strategic...
planning process is to first assess each type of strategic asset within each eco-region, and in the process determine the comparative advantage of each eco-region to pursue different value-added agricultural options. For example is it better to organizing a marketing alliance to export a specific value-enhanced crop or could farmers capture more value by investing in a value-added processing facility for a specific type of value-enhanced farm product. Figure 6 illustrates how this GIS information can be presented as an integrated series of (data) layers to facilitate decision-making.

![Asset-Mapping for Western Illinois Eco-Region](image)

Figure 6: Example of GIS Asset Mapping Data Layering

Conclusions

The purpose of this paper was to present an analytical framework that can be used in extension planning and to illustrate the use of GIS tools in spatially analyzing different types of asset mapping data. The value of spatial analysis is to enable farmers and other agricultural leaders to view these outputs as an integrated series of layers for each eco-region (or county) in the state. This type of analysis can facilitate and enhance farmer decision making as they seek investigate options to achieve sustainable rural economic development.

Reference


The Value Project is part of a special research initiative (SRI) on rural community development funded by the Illinois Council for Food and Agricultural Research (C-FAR). The Value Project’s goal is to help improve farm incomes and rural communities through value-added agriculture.