Segmenting the Commercial Producer Market for Agricultural Inputs

ABSTRACT: A cluster analysis procedure was used to develop a market segmentation of U.S. crop and livestock farms with annual sales in excess of $100,000. The results indicate that four distinct segments exist: convenience buyers, balance buyers, price buyers, and performance buyers. Differences in preferences across these segments have important implications for the marketing strategies of agricultural input suppliers.

Selected Paper for the 1999 AAEA Annual Meetings, Nashville, Tennessee

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INTRODUCTION

The farm producer is an important customer of virtually all agricultural input suppliers including equipment manufacturers and dealers, financial institutions, fertilizer and chemical companies, seed companies, and feed companies. Because the revenue of these industries is generated by purchases made by farm producers, information about the farm producer’s preferences for products and services is important to these industries. This information helps suppliers better match products and services to the needs of the customers. By better serving their customers, agricultural input suppliers can potentially increase sales and profits.

However, all farm producers are not the same. In fact, according to the September 1998 Agricultural Income and Finance Situation and Outlook Report, 16.7 percent of the nation’s farms (those with sales in excess of one-hundred thousand dollars) produce 81.4 percent of the livestock, 82.5 percent of the crops, and account for 77.3 percent of cash farm expenses in the United States (Resource Economics Division, Economic Research Service, 1998). Because farms with sales over $100,000, hereafter called commercial producers, represent such a large portion of cash expenses and thus input supplier revenues, it is worthwhile to examine this group in greater detail.

The central purpose of market segmentation is to identify segments, or groups of customers, that react differently to marketing choices (Riquier, Luxton, and Sharp, 1997). The main assumptions of the segmentation concept are 1) buyers can be grouped into segments such that preferences are homogeneous within segments and heterogeneous across segments, and 2) marketing offerings that are matched to the segments will outperform unmatched offerings (Green and Krieger, 1991).
Market segmentation is accomplished by identifying characteristics of customers which are associated with different preferences. Segmentation is frequently accomplished by grouping customers into segments according to sales classes, and then developing marketing strategies to serve the different segments. As more information becomes available about customers, marketers have advocated more rigorous, data intensive segmentation schemes. Under this methodology, many factors thought to influence preferences are used to form segments. This approach to segmentation is often implemented through cluster analysis (Punj and Stewart, 1982).

This study will use a clustering methodology to segment the commercial farm population according to this population’s preferences for factors related to key marketing variables. We define the commercial farm population as farm producers with annual sales from at least one enterprise (corn/soybeans, wheat/barley, cotton, dairy, beef, or hogs) in excess of $100,000. Survey returns from a sample of commercial producers are used to segment the population according to the importance of factors related to convenience/location, customer services/information (e.g., responsiveness, follow-up, advice), personal factors (trust, working relationships), price, product performance (e.g., yield, durability, rate of gain), and support services (e.g., delivery, repair, application) when selecting an input supplier. The results of the segmentation are then used to characterize the various segments along dimensions thought to affect the purchase decision.

METHOD

The reliance of market segmentation research upon clustering methods becomes apparent when one considers the interpretation of clustering given by researchers such as
Anderberg (1973), who identifies the objective of cluster analysis as grouping observations so that the level of natural association is high among group members and low across groups. The basic steps in cluster analysis include choosing variables to cluster or segment upon, selection of a clustering algorithm, choosing the solution, and validating the solution (Bernhardt, Allen, and Helmers, 1996).

In cluster based segmentation the researcher selects a series of variables that are thought to characterize buying behavior. Next, observations on these variables are submitted to an algorithm that places respondents with similar responses in distinct groups. Because the solution is a local optimum, special care must be taken to insure that the final segmentation is valid. Thorough methodological reviews of cluster analysis are offered by Punj and Stewart (1983) (marketing), Milligan and Cooper (1987) (psychology), Larson (1993) (agricultural economics), and Ketchen and Shook (1996) (strategic management). Three of a number of general textbooks include Anderberg (1973), Everitt (1980), and Aldenderfer and Blashfield (1984).

**The Clustering Methodology**

A split sample approach was used in this study. Dividing the sample in half provided an opportunity to validate the choice of cluster solutions and help insure that the solution is not a function of artifacts such as the ordering of the data. Once the sample was divided, the next step was to select the variables that define the clusters or segments and submit the observations on these variables to a clustering algorithm. At this point, it was necessary to select a specific clustering algorithm. Many authors have stated that a preferred approach is to first use a hierarchical procedure to find the number of clusters and then use the hierarchical solution as the seeds to the non-hierarchical k-means
clustering algorithm (Larson, 1993; Milligan and Cooper, 1987; Ketchen and Shook, 1996).

In this research, Ward’s hierarchical clustering method was used to identify the number of clusters and provide the seed values for the k-means non-hierarchical algorithm. This two step procedure was equivalent to accepting the hierarchical clustering variable means conditional on cluster membership as the prior belief of the final conditional cluster means. Next, the k-means algorithm rearranged the observations optimally given the seeds or prior belief about the cluster means. The cluster means were then recomputed and observations reassigned to the nearest cluster mean. The means were then recalculated and observations reassigned. The process repeated until no observation changed clusters (SAS, 1989). The k-means solution is then the updated prior of the conditional clustering variable means. The belief in the updated prior can then be strengthened or weakened by tests of group differences on non-clustering variables and the results of classification estimation methods such as discriminant classification analysis.

DATA

Sudman and Blair (1999) point out that when sampling rare populations such as the commercial farm population, the first step is to determine if a good list of population members is available. The farms in this sample were identified from a very large private database that contained information on farm size, enterprise type, and location. Based on the desired response rates, 10,500 surveys were mailed to farms believed to have sales in excess of $100,000.
The survey instrument was designed with the input of academics, representatives from several large agricultural input firms, and the firm in charge of administering the survey. The initial survey instrument was pre-tested with farmers in February 1998. After changes were made, the final survey instrument and return envelope were mailed in March 1998. A follow-up reminder card was sent approximately two weeks after the initial mailing. Next, calls were made to non-respondents in late March. Data collection ended in April 1998. Of the 10,500 surveys mailed, 1,742 usable questionnaires were returned, for a response rate of 16.6 percent. Although the response rate appears low, it was in line with expectations of 20 percent. (A copy of the questionnaire, which provided data on 256 response variables, can be found in Gloy, 1999).

Respondents that operated farms with sales between $100,000 and $500,000 made up 39 percent of the sample, while the remainder had sales in excess of $500,000. With respect to enterprise type, corn/soybean farms accounted for the largest percentage of respondents (27.5 percent) and wheat/barley growers made up the smallest percentage of total respondents (11.6 percent). In general, the responses by enterprise and sales class were reasonable.

RESULTS

Twelve questions measured on a forced sum scale serve as ideal segmentation bases (clustering variables). The questions asked respondents to assign a percentage to the influence of several factors toward their choice of input supplier for capital goods and expendable goods. The question was stated as: When you choose a **supplier** for either capital items like equipment or expendable items like pesticides or feed, how is your decision influenced by the following factors? Assign a percentage value to each factor.
based on its importance in the decision. Each column should sum to 100. (There was a column for expendables and a column for capital items.) The response categories included convenience/location, customer services/information (e.g., responsiveness, follow-up, advice), personal factors (trust, working relationships), price, product performance (e.g., yield, durability, rate of gain), and support services (e.g., delivery, repair, application). The segments derived from this segmentation base reflect these differing benefits desired from suppliers. The responses to these variables were submitted to the hierarchical algorithm which produced various statistics which were used to identify the number of clusters or segments in the marketplace.

The Pseudo F and Pseudo T Squared statistics are often used to help determine the number of clusters in the data (Milligan and Cooper, 1987). The Pseudo-F statistic has a local peak at three clusters for the entire sample and a flat top at three and four clusters for both of the split samples. This would indicate that the data likely contains three or four clusters. The Pseudo-T Squared statistic falls sharply when going from three clusters to four clusters in sample 2 and the entire sample also shows a trough forming at four clusters. Sample 1 shows a slight trough at seven clusters. These results indicate a four cluster solution in sample 2 and the entire sample. Taken together these statistics point to a four cluster solution (details are presented in Gloy, 1999).

The clustering variable means conditional on Ward’s cluster membership were input to the FASTCLUS procedure in SAS as initial seeds. The k-means algorithm altered Ward’s solution by enlarging the largest cluster produced by Ward’s method and reducing the size of the other three clusters.
Significant differences between the segment means of the clustering variables is expected and not statistically meaningful. (The clustering algorithm grouped the observations in a way that maximized these differences). However, these means can be used to name the segments and determine what features segment members desire from their suppliers. The means of the six expendable clustering variables are presented for each segment in Table 1 (The six capital clustering variables results are very similar)\(^1\).

The entries in Table 1 are the average percentage influence that each expendable factor has on the supplier choice in each cluster. Therefore, each entry represents the average of the relative importance that segment members place on each factor.

<table>
<thead>
<tr>
<th>Factor</th>
<th>Balance</th>
<th>Convenience</th>
<th>Performance</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Convenience/Location</td>
<td>16</td>
<td>57</td>
<td>8</td>
<td>13</td>
</tr>
<tr>
<td>Service/Information</td>
<td>16</td>
<td>8</td>
<td>7</td>
<td>6</td>
</tr>
<tr>
<td>Personal Factors</td>
<td>17</td>
<td>9</td>
<td>8</td>
<td>7</td>
</tr>
<tr>
<td>Price</td>
<td>20</td>
<td>14</td>
<td>20</td>
<td>54</td>
</tr>
<tr>
<td>Product Performance</td>
<td>16</td>
<td>6</td>
<td>49</td>
<td>14</td>
</tr>
<tr>
<td>Support Services</td>
<td>15</td>
<td>6</td>
<td>8</td>
<td>7</td>
</tr>
<tr>
<td>Percent of Sample</td>
<td>47</td>
<td>15</td>
<td>16</td>
<td>21</td>
</tr>
</tbody>
</table>

The members of the Balance segment represent 47 percent of the respondents.

Table 1 shows that members of this segment weight the various factors very evenly when selecting a supplier. Price, 20 percent of the choice, is the largest factor when selecting a supplier.

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\(^1\) An analysis was conducted using only the six expendable clustering variables. The results did not drastically alter the clustering solution.
supplier, but the smallest, support services is only 5 percent smaller. This segment is looking for a supplier who can provide a wide array of services and information, reasonable prices, and products that perform well. The Balance segment is by far the largest segment in the marketplace of commercial producers.

The Convenience segment is 15 percent of the marketplace. Convenience segment members place a great deal of importance (over half of the weight in the decision) on convenience and location factors. As can be seen in Table 2, members of this group place a lower weight on price than members of any other group. This group also weights personal factors more heavily than all segments except the Balance segment. Finally, they place less weight on performance factors than any other group.

The Performance segment is approximately 16 percent of the sample. Its members base half of their supplier choice decision on product performance factors. Price is the next most important feature. Members of this segment weight the other factors almost evenly on average. Thus, the segment contains buyers who are very focused on obtaining products that perform well.

The final segment identified was the Price segment. Members of this segment accounted for 21 percent of the commercial producers in the sample. Table 2 clearly shows that these producers place a great deal of weight (54 percent) on price factors when selecting an input supplier. This is over twice the weight placed on price by members of the other segments. The low ranking of personal factors indicates that members of this segment place little value in working relationships when choosing their supplier. It is likely that members of this segment change suppliers frequently. The ability of the
supplier to provide service and information is also rated low. Supporting services such as
delivery and custom application are also rated low.

In an effort to assess the predictability of the segmentation, a discriminant
classification model was estimated. The dependent variable was cluster membership and
ten of the twelve clustering variables served as independent variables. Eighty percent of
the sample was used to estimate the parameters of the model and predictions were
generated for the remaining twenty percent of the sample. The model correctly identifies
all of the Convenience members, 99 percent of the Balance members, 98 percent of the
Price members, and 98 percent of the Performance members in the hold out sample. The
results show that the segmentation is predictable given the data used to form the
segments. This tends to support the claim that the segmentation is valid and not spurious.
For example, a discriminant model was also used to predict membership in the Ward’s
solution. This model classified only 87 percent of the out of sample observations
correctly.

Using The Results

Four segments of the commercial producer marketplace have been identified.
These segments vary with respect to what they desire from their suppliers. The goal of
the segmentation is not to suggest that one segment is the most desirable segment for all
suppliers. Rather the purpose is to help marketers identify groups of producers that will
be most likely to desire their products and/or services. It is believed that any segment can
be profitably served with the correct product/service mix. In order to help suppliers
assess which segment represents the best target market or markets, the segments were
examined with respect to many factors that characterize the product/service mix that they are likely to desire. Significant differences existed across the segments with respect to responses related to demographics, goals and attitudes, management practices/tools used, off-farm influences on the purchase decision, brand preferences, loyalty, and preferences for salespeople. Segment profiles were developed based on responses where the probability of no difference across groups was less than 0.15. Detailed responses by segment can be found in Gloy, 1999.

Segment Profiles

The Balance segment is the largest segment of commercial producers. These producers are some of the most sophisticated users of technologies like precision farming, computers, and the internet. They are also sophisticated buyers, who although they have the most favorable view of generic products, do not frequently purchase the lowest priced items. Balance buyers are the most reliant on off-farm sources of information when making purchase decisions. Of special importance is the local dealer and local sales representative. Balance buyers are the most focused on finding sales representatives and dealers who are familiar with their operations. These producers also make heavy use of custom services. The implication is that this segment is likely to be a lucrative market for suppliers offering sophisticated technologies and services. The likelihood of selling these products will be improved by designing services and technologies for these producer’s specific operations. They are also an important market for local dealers who offer custom services.

The Convenience segment is the smallest market segment in the commercial producer marketplace. These producers tend to be older individuals operating smaller
farms. Members are characterized by placing greater importance on goals such as reducing risk and passing on the farm. They prefer to buy products from one supplier and agree that they are willing pay more to buy products from locally owned suppliers. These producers value the information and services of the local dealer a great deal more than that provided by manufacturer technical and sales people. With respect to salespeople, the Convenience segment is much more impressed than other segments by a sales representative that calls frequently. Members of this segment are highly reliant upon and loyal to local influences. Product marketing and brand positioning is more likely to be successful if local dealers are involved in the process. The older age of these producers has implications for the products and services that these producers will find useful. For instance, products designed to manage risk would be more useful to these producers than Performance buyers.

Performance buyers make up about 16 percent of the market. Its members are the most well educated farm producers. Performance buyers are focused on the performance of the products that they buy. They see clear distinctions between brands and are unlikely to buy on price alone. Performance producers require a sales representative who is technically competent. This segment is an ideal market segment for suppliers marketing premium branded products that are differentiated by performance features.

The Price segment is the second largest segment. Its members operate the largest farms and are very focused on goals related to achieving financial success. They have the lowest adoption rates of costly technologies such as precision agriculture and are the least heavy users of custom services. A large percentage own computers and are active on the internet. Members are less likely to care if their sales representative is familiar with their
operation, but are very interested in whether the representative can deal with them on price. They are the least likely to buy products from one supplier and rate the importance of the local dealer the lowest. An important characteristic of this segment is that members are intent on purchasing the lower priced of two alternative products. It is likely that they will switch input suppliers frequently to realize these lower prices. These producers also have the least favorable view of local dealers. This implies that manufacturers trying to sell products without local dealer networks would likely find this a good target market. Efforts by local suppliers to capture Price buyers with one time price reductions will likely result in a one time purchase only.

This paper presented the results of a market segmentation of the commercial producer marketplace. A clustering methodology was used to identify segments that desired different benefits from input suppliers. The results show that four segments emerge. The largest segment, the Balance segment, desires a supplier who can provide a wide array of services, reasonable prices, and products that perform well. The Convenience segment contains buyers who place a great deal of importance on factors related to convenience and location of their suppliers. Performance buyers are very focused on their suppliers’ ability to provide durable products and services that produce the highest yields or rates of gain. Finally, the Price segment contains buyers who focus intensely on the prices that their suppliers are capable of offering. Agricultural input suppliers can use these results to assess the characteristics of their target market and design products and services with the needs of each segment in mind.
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