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How Large Commercial Producers Choose Input Suppliers: Expendable Products from Seed to Animal Health

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Abstract

This study uses cluster analysis to identify buying behavior segments of commercial producers who purchase expendable products including seed, crop protection, animal health and feed. For the crop expendable products we find four buying behavior segments: Convenience, Price, Performance, and a fourth segment, called Balance buyers, who equally value the aforementioned factors as well as customer service and support services. For livestock expendable products we find three buying behavior segments: Balance, Price and Performance. We find that producers have product-specific buying behaviors and this is especially true for livestock producers. We discuss the implications of these customer segments for expendable input marketers and salespeople.

Keywords: Cluster Analysis, Expendable Inputs, Market Segmentation, Commercial Producers

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Determining how current and potential new customers make purchasing decisions and choose a supplier is of particular interest to agricultural input retailers of expendable products, which are consumed by the farming enterprise and must be purchased frequently. Knowledge of producers' purchasing preferences enables input suppliers to market products targeted towards the needs of customers, which can increase sales and customer satisfaction (Gloy and Akridge, 1999). This task has become increasingly difficult with changes in the U.S. farm sector. As farm consolidation continues, purchasing decisions will be made by fewer operators who manage larger farms (Alexander, Wilson, and Foley, 2005). Therefore, the focus of this research is on U.S. commercial producers, who are defined as those running operations with annual sales of \$100,000 or more. Though commercial producers account for only 16.2% of farms, they account for 87.2% of total farm production expenses (USDA, 2007). Therefore, agricultural suppliers must continually adapt their marketing strategies to retain this shrinking number of customers who are getting more powerful.

This paper presents a behavioral segmentation of commercial U.S. producers in the expendable input industry (seed, crop protection, animal health, and feed products) for the agricultural/agribusiness sectors. It extends prior research of Gloy and Akridge (1999) and Alexander, Wilson and Foley (2005) on buying segments for inputs in agriculture by providing comparisons of decision making process used by segment members in different input categories, as opposed to one broad category of expendable inputs. Cluster analysis is used to segment the commercial producer market based on survey data describing their buying behavior for expendable products. The goal of market segmentation is to classify producers into groups with homogeneous preferences within the group, and maximize the differences between the groups. Once these different segments are identified and profiled, specific marketing strategies of products, pricing, promotion, and distribution can be tailored to the preferences of targeted segments. Kotler (1997) suggests that customers will make purchases from firms that create the highest perceived value, and since the process of tailoring marketing strategies to specific market segments can increase customer's perception of value, firms will have the ability to attract and retain customers (Roucan-Kane et al., 2010).

Of particular interest in this study is how, if at all, these market segments differ between various types of expendable items. The study focuses on four expendable items: seed and crop protection products for crop producers, and animal health products and feed for livestock producers. Crop and livestock producers are respondents that considered the primary focus of their farm to be crop production or livestock production, respectively. The four categories of expendables chosen for this research are integral to the production of crop or livestock commodities. Because of the frequency and commonality of their purchase, understanding the nature of decision-making for them is important for researchers and suppliers. The results of this study suggest that producers differ in their purchasing decisions across expendable product categories indicating that input suppliers need to develop tailored marketing strategies for each expendable product category.

Agricultural Producer Markets

There have been a variety of studies on segmentation in the agricultural producer markets. Mwangi (1991) performed a cluster analysis on a central Illinois-based producer survey to segment the retail fertilizer and agricultural pesticide market. Her study used a market segmentation

method that considered the benefits sought by customers as a basis for creating homogenous customer groups. The study identified four distinct groups based on these benefits: knowledge seekers, reputation seekers, price seekers, and integrity seekers. Based on these segments, Mwangi suggested possible marketing strategies for retailers. Those retailers actively targeting the knowledge seekers segment should train their salespeople to provide reliable advice on fertilizer and pesticide application to producers. Retailers targeting the price seekers segment need to deliver product packages with low prices. Retailers targeting reputation seekers need to be cognizant of their standing in the community, while retailers targeting integrity seekers need to emphasize the importance of integrity in their sales force.

Hooper (1994) used data from the inaugural large commercial producer survey conducted by the Center for Food and Agricultural Business (CAB) at Purdue University in 1993. His focus was segmenting the market for agricultural inputs for producers with gross sales greater than \$100,000 and a primary operation of corn/soybeans, wheat, cotton, dairy, beef, or hogs. His cluster analysis was conducted on 30 factors ranging from farmers' expectations about the future of their farming operation to specific farming practices such as new product adoption and the use of agronomic consultants. He identified a total of eight market segments, with the largest segment being Traditionalists who expect their farm to stay the same and are likely to maintain the status quo. Like Mwangi, Hooper suggested a marketing strategy for each segments consisting of product, place, price, and promotion.

Gloy and Akridge (1999) conducted a study using CAB's second large commercial producer survey in 1998. Using a two-step clustering process, U.S. crop and livestock farms with annual sales in excess of \$100,000 were segmented based on weights applied to six factors that affect the choice of an input supplier. The factors included convenience/location, customer service/information (e.g., responsiveness, follow-up, advice), personal factors (e.g., trust, working relationships), price, product performance (e.g., yield, durability, rate of gain), and support services (e.g., delivery, repair, application). They identified four market segments: balance, convenience, performance, and price. These market segments were then characterized by their demographics and responses to attitudinal and behavioral questions. Based on these market segment characteristics, the authors offered strategies that could be used to target specific segments. However, one limitation of the 1998 survey is that respondents were asked to describe their purchasing behavior for expendable items in general, which did not allow the authors to consider whether buying behavior may differ across expendable input categories, such as seed and feed.

Based on CAB's 2003 large commercial producer survey, Foley (2003) conducted an analysis parallel to Gloy and Akridge (1999) who analyzed the 1998 large commercial producer survey data. Prior to running the cluster analysis, Foley conducted a factor analysis on the six decision factors used by Gloy and Akridge and found that "personal factors" and "customer service/information" provided the same information. Thus, Foley combined these two variables into an overall customer service/information variable for a total of five decision factors. Again a two-step clustering procedure was used and five customer segments were identified, the same four from Gloy and Akridge (1999) with an additional service segment. Foley (2003) expanded on Gloy and Akridge (1999)'s work by introducing a multinomial logit model that was used to predict segment membership using descriptive and attitudinal variables. Foley's model was successful in identifying characteristics that can be used to predict segment membership. The 2003

version of the survey, much like the 1998 version used by Gloy and Akridge (1999), only asked respondents about expendable input items and so could not test if market segment membership varied for distinct categories of inputs such as seed.

Alexander, Wilson, and Foley (2005) used both data sets from the 1998 and 2003 versions of the large commercial producer survey to compare the input market segmentation from 1998 to 2003. The data combination was possible as 76% of the questions that appeared on the 2003 survey were also on the 1998 survey. The two-step clustering method from Gloy and Akridge (1999) and Foley (2003) was used and identified the same five market segments as in Foley (2003) for both survey years 1998 and 2003. A multinomial logit regression analysis was also used to predict segment membership based on observable characteristics. Their study found that the convenience segment decreased in size from 1998 to 2003 with the performance, price, and service segments gaining substantial membership.

Data

This study uses the data from the Center for Food and Agricultural Business's 2008 Large Commercial Producer Survey which was conducted via phone during January and February 2008. The survey was specifically targeted to reach a representative sample of mid-size and large producers in six enterprise classes: corn/soybeans, wheat/barley/canola, cotton, dairy, swine, and beef. The sample was stratified by state with state quotas so that the sample would contain producers in states that accounted for 75 percent of 2007 U.S. production in each of the six target enterprise classes. Three versions of the survey were used: a crop version, a livestock version, and a joint crop/livestock version. Each respondent was assigned the version of the survey depending on whether they considered crop production or livestock production to be the primary focus of their farm. A total of 2,574 observations were obtained from the survey, with 980 from the crop version, 378 from the livestock version, and 1,216 respondents completing joint crop/livestock version. In this study we focus on only responses to the crop and livestock versions and drop the joint crop/livestock version to avoid confusion about which expendable items the respondent may have been referring to.

Method

The cluster analysis was conducted four times, once for each of the four expendable products: seed, crop protection chemicals, animal health, and feed. The method follows the approach of Gloy and Akridge (1999), Alexander, Wilson and Foley (2005), and Roucan-Kane et al. (2010). The first step is selecting clustering variables for the four expendable products. Instead of using demographics, we used responses to behavioral questions because behavioral data is more descriptive of a customer's basic reasons for purchase (Assael, 1981). The key survey question asked respondents to weigh the influence of five factors they may use to choose their supplier of the four expandable products. For example, for seed products, the respondents assigned weights to the factors on a force sum scale according to the following question: *When you choose a supplier for seed products, how is your decision influenced by the following factors? Assign a percentage value to each factor based on its importance in the decision. The percentages should add to 100% in each column.* The five factors included: convenience/location, customer service/information, price, product performance, and support services. The crop version of the sur-

vey also asked the same question for crop protection products while the livestock version asked the same question for animal health and feed products.

Before the clustering analysis began, the total set of observations needed to be reduced to appropriate samples. Observations for the seed and crop protection cluster analysis were restricted to those 980 respondents who completed only the crop version of the survey. Likewise, observations for the animal health and feed cluster analysis were restricted to those 378 respondents who completed only the livestock version of the survey. Further data cleaning consisted of deleting 136 observations that had a farm size less than the lower bound of the mid-size farm definition as defined by Alexander et al. (2009). In addition, observations that allocated the full 100% to any single decision factor were removed as this result suggests response bias likely due to the difficulty of answering the question; we deleted 84 observations for seed and crop protection, and 86 observations for feed and animal health products. After data cleaning was complete the final sample sizes for the cluster analyses were 855 observations each for seed and crop protection products, 283 observations for animal health products, and 281 observations for feed.

Clustering provides a method for classifying a large number of observations across many variables, but potentially describes random connections if a theoretical basis for relationships or triangulation with other studies is not used to augment researchers' judgments about what the classifications mean (Ketchen Jr. and Shook, 1996). For this analysis, the same clustering algorithm was used as Gloy and Akridge (1999), Alexander, Wilson and Foley (2005), Roucan-Kane et al. (2010) and Roucan-Kane et al. (2011) which is a two-step process. We first used a hierarchical clustering algorithm (Ward's Minimum Variance) to identify the appropriate number of clusters and obtain seed values for a subsequent non-hierarchical clustering algorithm (k-means). Both estimation procedures were conducted in SAS (1989).

Results

Based on the hierarchical clustering step and using the pseudo F-statistic, we identified four clusters for seed and crop protection products, and three clusters for animal health and feed products. While the pseudo-F statistic is one criterion for choosing the optimal number of clusters, researchers also need to confirm that the resulting clusters are measurable, actionable and significant. Tables 1-4 present the sample means for the clustering variables and the cluster names based on the largest factor for seed, crop protection, animal health, and feed products, respectively. For example, the price segment is composed of respondents who consider price to be the major criterion in their purchase decision. To validate the cluster results, we used cross-tabulations with chi-square test for significant segment differences on non-clustering variables such as demographics, farm characteristics, influences on purchasing decisions, and brand preferences and attitudes.

The cluster analysis identified four market segments for seed and crop protection chemicals, and three market segments for animal health and feed. This initial result suggests producers' purchasing decisions for expendable inputs vary based on whether they are crop-specific or livestock-specific. Also within a specific product, e.g. seed, the market segments vary with respect to the influence a specific factor has on a producer's purchasing decision.

Table 1. Relative Importance by Segment of each Factor for Seed Products

Factor	Market Segments for Seed Products			
	Balance	Price	Performance	Convenience
Convenience/Location	18	15	6	52
Customer Service	21	17	9	25
Price	21	47	17	13
Performance	25	16	61	6
Support Service	16	5	7	4
Percent of Sample	58.2%	13.8%	17.9%	10.1%

Table 2. Relative Importance by Segment of each Factor for Crop Protection Products

Factor	Market Segments for Crop Protection Chemicals			
	Balance	Price	Performance	Convenience
Convenience/Location	17	11	7	42
Customer Service	21	13	9	27
Price	23	47	16	18
Performance	24	23	62	9
Support Service	16	5	7	4
Percent of Sample	57.0%	18.0%	14.4%	10.6%

Table 3. Relative Importance by Segment of each Factor for Animal Health Products

Factor	Market Segments for Animal Health Products		
	Balance	Price	Performance
Convenience/Location	28	24	10
Customer Service	24	11	13
Price	19	50	22
Performance	16	10	43
Support Service	14	6	12
Percent of Sample	57.6%	17.7%	24.7%

Table 4. Relative Importance by Segment of each Factor for Feed Products

Factor	Market Segments for Feed		
	Balance	Price	Performance
Convenience/Location	25	23	10
Customer Service	23	16	10
Price	19	49	30
Performance	17	8	40
Support Service	17	4	10
Percent of Sample	58.4%	19.9%	21.7%

Segments' Characteristics

Balance. For all four products, the Balance segment is the largest, representing between 57% and 58.4% of the farms (Tables 1-4). Buyers in the Balance segment consider all of the input supplier's criteria (convenience/ location, customer service, price, performance, and support service) to be equally important. That said, the relative weighting of these factors depends on the product. For the seed Balance segment, the most important factor is product performance (shown in bold in Table 1, with the most important factors for each segment bolded similarly in Tables 2-4), with price and customer service tied for second most important. For the crop protection chemicals Balance segment, the most important factor is also performance with price being ranked a close second. For both the animal health products and feed Balance segments, the most important factor is convenience/location followed by customer service.

Price. Producers in the Price segment placed a large emphasis (47-50%) on product price. The price segment is the second-largest segment for crop protection chemicals at 18% of farms; and the third-largest segment for seed at 13.8% of farms, animal health at 17.7% of farms, and feed at 19.9% of farms. For the seed Price segment, price buyers rank customer service, performance and convenience/location about equally, while for the chemicals Price segment product performance is clearly the second most important factor. For the livestock inputs Price segment, convenience/location is the second most important factor for price buyers.

Performance. Producers in the Performance segment placed a large emphasis on product performance, at 61-62% for crop inputs and at 40-43% for livestock inputs. The performance segment is the second-largest segment for seed at 17.9% of farms, animal health products at 24.7% of farms, and feed at 21.7% of farms; and third-largest segment for chemicals at 14.4% of farms. For all four products, performance buyers rank price as the second most important factor.

Convenience. The Convenience segment is only present for crop inputs (seed and crop protection chemicals) and it was the smallest segment with roughly 10% of the farms. This segment placed a large emphasis on convenience/location at 52% for seed and 42% for chemicals. Customer service/information was the second most important factor to the Convenience segment.

Characterizing these segments enables suppliers to identify groups of producers and develop a marketing strategy that best creates value for that group. Gloy and Akridge (1999) contend that, for any reasonably sized market segment, a supplier can design a product/service mix to profitably serve that target segment. The designation of a reasonably-sized market segment depends on the supplier and the sales generated by that target market, i.e. a combination of the number of farms in the segment, the size of those farms, and the price they are willing to pay for the product. For crop input suppliers, the Convenience segment is the smallest and these suppliers will need to decide whether it would be more profitable for them to design a marketing program targeted to this segment or to passively serve this segment. Passively serving this market segment means that suppliers offer the Convenience buyers a marketing campaign that is targeted at other segments. This strategy will only partially satisfy the Convenience segment but will also require the smallest investment. Consistent with characteristics described by Gloy and Akridge (1999), the rest of the discussion regarding the market segments for the four expendable items is organized into the following sections: demographics, outside influences on the farm purchasing deci-

sions, brand preferences, loyalty, and price. Lastly, we compare market segments for crop production products, seed and chemical protection products, and for livestock production products, animal health and feed.

Demographics and Farm Characteristics

We focus on the three main demographics of farm size as measured by gross sales, education, and age. As noted by Assael (1981), demographic variables are less accurate in predicting which market segment a producer will belong to than behaviors are, demographic characteristics are easily observable and usable by suppliers to identify market segment membership. Table 5 presents cross tabulations of members in each segment by each demographic variable. The Pearson chi-square statistic is used to test for statistical significance of the distributions by market segment. The F-test is used to test for the statistical significance of the mean age by market segment.

With the exception of animal health product market segments, farm size and age characteristics were found to be significantly different across the segments. For all products, Performance buyers tended to operate the largest farms while for crop inputs Convenience buyers clearly operate the smallest farms. While there was no significant difference in the education levels of members across the segments, there tended to be a higher percentage of college graduates in the Price and Performance segments which is consistent with Gloy and Akridge (1999) and Alexander, Wilson and Foley (2005).

Influences of the Purchase Decision

It is common in production agriculture for producers to seek advice from others within or outside the operation. A simple example is demonstrated by agronomic consultants -- their advice has large impacts on the specific crop protection products used by producers (Gloy and Akridge, 1999). It is important for input suppliers to understand which on- or off-farm parties have the most influence on purchasing decisions. Marketing strategies can be built around this knowledge that includes educating and advertising to those parties that have influence on purchasing decisions about their products.

Two sets of questions in the survey were used to determine if purchasing decision influences exist or not. The first was the use of consultants, specifically independent crop, environmental, and management consultants for crop producers and independent nutritionists, environmental, management, and veterinarian consultants for livestock producers. Of the producers using these various types of consultants, the only significant difference was for the use of environmental consultants by the crop protection chemical market segments (Table 6). While not statistically significant, Performance buyers across all product categories tended to be more likely to hire consultants than other segments.

Table 5. Farm Demographics and Characteristics Organized by Input

Demographic	Total Sample	Balance	Price	Performance	Convenience	Prob of No Assoc. ¹
Seed						
Sales < \$500,000	39%	40%	40%	29%	52%	
Sales \$500,000 - \$1M	28%	27%	28%	29%	30%	18.96***
Sales > \$1M	33%	34%	32%	43%	17%	
College Graduate	33%	32%	36%	33%	30%	1.09
Age < 35	4%	5%	2%	2%	8%	
Age 35 – 44	15%	13%	20%	17%	14%	
Age 45 – 54	37%	35%	39%	42%	30%	22.43**
Age 55 – 64	28%	28%	31%	25%	24%	
Age > 65	16%	18%	9%	14%	23%	
Mean Age	53.4	53.7	52.4	52.9	53.9	0.59
Crop Protection						
Sales < \$500,000	39%	39%	34%	33%	55%	
Sales \$500,000 - \$1M	28%	27%	33%	29%	22%	14.62**
Sales > \$1M	33%	34%	33%	38%	23%	
College Graduate	33%	32%	36%	32%	33%	0.94
Age < 35	4%	5%	6%	1%	4%	
Age 35 – 44	15%	13%	20%	13%	17%	
Age 45 – 54	36%	36%	34%	48%	26%	22.41**
Age 55 – 64	28%	29%	25%	23%	28%	
Age > 65	17%	16%	14%	16%	25%	
Mean Age	53.4	53.4	52.0	53.8	55.0	1.52
Animal Health						
Sales < \$500,000	38%	42%	36%	30%		
Sales \$500,000 - \$1M	24%	25%	24%	21%		5.72
Sales > \$1M	38%	33%	40%	49%		
College Graduate	25%	21%	26%	33%		3.84
Age < 35	5%	4%	10%	3%		
Age 35 – 44	14%	14%	16%	16%		
Age 45 – 54	36%	36%	38%	33%		8.46
Age 55 – 64	29%	27%	22%	37%		
Age > 65	16%	19%	14%	11%		
Mean Age	53.8	54.6	51.1	53.8		1.88
Feed						
Sales < \$500,000	38%	45%	36%	20%		
Sales \$500,000 - \$1M	23%	22%	21%	26%		12.68**
Sales > \$1M	40%	34%	43%	54%		
College Graduate	24%	20%	34%	26%		4.51
Age < 35	5%	6%	5%	3%		
Age 35 – 44	14%	12%	27%	10%		
Age 45 – 54	35%	32%	36%	39%		19.48**
Age 55 – 64	28%	26%	25%	36%		
Age > 65	18%	24%	7%	12%		
Mean Age	54.2	55.5	50.0	54.7		5.00***

¹Probability of no association represents the Pearson chi-square in the case of the chi-square test of cross tabulation or the F statistic in the case of the Anova table.

*, **, and *** represent 0.10, 0.05, and 0.01 levels of statistical significance, respectively.

Table 6. Use of Consultants by Product and Market Segment

Purchasing Decision Influences					χ^2
	Balance	Price	Performance	Convenience	Statistic¹
Seed					
Independent Crop Consultant	31.6%	29.7%	40.9%	34.5%	5.30
Environmental Consultant	5.2%	5.1%	3.9%	5.8%	0.54 ^a
Management Consultant	9.2%	7.6%	9.8%	8.1%	0.50
Crop Protection					
Independent Crop Consultant	32.3%	34.9%	38.3%	32.6%	1.72
Environmental Consultant	4.1%	6.5%	3.3%	9.9%	6.87** ^a
Management Consultant	10.3%	6.5%	6.5%	9.9%	3.16
Animal Health					
Independent Nutritionist	51.0%	52.1%	53.1%		0.08
Environmental Consultant	23.9%	24.0%	28.6%		0.60
Management Consultant	14.7%	12.0%	15.7%		0.34
Veterinarians	83.2%	72.9%	85.9%		3.51
Feed					
Independent Nutritionist	54.0%	51.9%	63.6%		1.90
Environmental Consultant	26.2%	21.4%	32.8%		1.97
Management Consultant	13.4%	17.9%	16.4%		0.78
Veterinarians	83.3%	83.3%	83.6%		0.00

¹ Pearson chi-square statistic and its significance where *, **, *** represent 0.10, 0.05, and 0.01 levels of statistical significance, respectively.

^a For the Pearson Chi-Square test, one cell had an expected cell count less than 5.

In a second set of questions, respondents were asked about their decision-making process. For each of the expendable items, respondents were instructed to select how purchase decisions are made from five response answers: made by me with very little input, made by me after discussion with family and/or employees, made by the person responsible for using the item after discussion with others on the farm, made by the person responsible for the item with little input from others, or made by a purchasing agent hired by our farm (Table 7). Of the four expendable items only seed was found to have significant differences between the segments. Specifically, Price buyers were more likely to make decisions with little input from others whereas the Performance segment relies on purchasing agents more than other segments. The Balance segment relies on family more than others. While not statistically significant, Price buyers in the other product categories also tended to make their decisions with little input from others.

Brand Preferences and Loyalty

Product branding and its effects on purchase decisions can be integrated into a personalized marketing strategy. Practically, all input products are branded by quality characteristics and pricing. A producer evaluates the quality and price combination to determine the appropriate purchase decision (Gloy and Akridge, 1999). To assess whether or not branding characteristics vary across market segments, respondents were instructed to respond to a series of statements about brands and brand loyalty on a five-point Likert scale with 1 representing strongly disagree and 5 representing strongly agree. To test for differences across segments participants that responded either 4 or 5 on the Likert scale were grouped and their percentage of all the total respondents reported in Table 8. The Pearson chi-square test statistic for no association is also reported.

Table 7. Relative Influence of Family, Employees, and Agents on Purchasing Decisions

Purchasing Decision Influences	Balance	Price	Performance	Convenience	χ^2 Statistic ¹
Seed					
Made by me with very little input from family members and/or employees	57.0%	61.9%	58.8%	53.5%	
Made by me after extensive discussions with other family members and/or employees	28.1%	20.3%	22.9%	26.7%	
Made by the person responsible for using the item after extensive discussion with others on the farm	7.2%	7.6%	5.9%	4.7%	
Made by the person responsible for the item with little input from anyone else	6.2%	9.3%	6.5%	12.8%	21.42**
Made by a purchasing agent hired by our farm	1.4%	0.8%	5.9%	2.3%	
Crop Protection					
Made by me with very little input from family members and/or employees	49.5%	51.3%	43.1%	52.7%	
Made by me after extensive discussions with other family members and/or employees	27.9 %	26.6%	29.3%	27.5%	
Made by the person responsible for using the item after extensive discussion with others on the farm	8.6%	9.7%	9.8%	7.7%	6.04
Made by the person responsible for the item with little input from anyone else	9.9%	9.7%	10.6%	8.8%	
Made by a purchasing agent hired by our farm	4.1%	2.6%	7.3%	3.3%	
Animal Health					
Made by me with very little input from family members and/or employees	54.0%	60.0%	47.1%		
Made by me after extensive discussions with other family members and/or employees	25.2%	18.0%	31.4%		
Made by the person responsible for using the item after extensive discussion with others on the farm	6.7%	12.0%	12.9%		
Made by the person responsible for the item with little input from anyone else	4.3%	2.0%	7.1%		11.95
Made by a purchasing agent hired by our farm	9.8%	8.0%	1.4%		
Feed					
Made by me with very little input from family members and/or employees	51.2%	60.7%	47.5%		
Made by me after extensive discussions with other family members and/or employees	29.3%	23.2%	36.1%		
Made by the person responsible for using the item after extensive discussion with others on the farm	7.3%	5.4%	8.2%		
Made by the person responsible for the item with little input from anyone else	4.3%	5.4%	4.9%		4.79
Made by a purchasing agent hired by our farm	7.9%	5.4%	3.3%		

¹Pearson chi-square statistic and its significance where *, **, *** represent 0.10, 0.05, and 0.01 levels of statistical significance, respectively.

Table 8. Respondent Attitudes towards Brands by Product by Market Segment

Purchasing Decision Influences					
	Balance	Price	Performance	Convenience	χ^2 Statistic¹
Seed					
For the seed I buy, most brands are more or less the same	21.5%	27.1%	11.1%	29.1%	15.02***
I consider myself loyal to the brands of seeds I buy	52.4%	41.5%	41.8%	47.7%	8.09**
Crop Protection Chemicals					
For the crop protection chemicals I buy, most brands are more or less the same	36.1%	35.7%	25.2%	34.1%	5.39
I consider myself loyal to the brands of crop protection chemicals I buy	39.2%	27.3%	29.3%	38.5%	9.92**
Animal Health					
For the animal health products I buy, most brands are more or less the same	33.7%	32.0%	27.1%		0.98
I consider myself loyal to the brands of animal health products I buy	48.5%	30.0%	42.9%		5.34*

¹Pearson chi-square statistic and its significance where *, **, *** represent 0.10, 0.05, and 0.01 levels of statistical significance, respectively.

The segments have significantly different views of Brands (Table 8). Specifically for seed, only 11.1% of Performance buyers agreed that most brands are more or less the same, compared to 29.1% of Convenience buyers. For chemicals and animal health products, Performance buyers were the least likely to agree that brands are more or less the same, though this difference was not statistically significant. Brand loyalty also differed by segment and by product. The Price segment was the least likely to be loyal to a specific brand for seed, chemicals and animal health products (this question was not asked for feed), and these differences were statistically significant. For the crop inputs, Performance buyers also tended to be less brand loyal than Balance and Convenience buyers. Respondents were also asked a series of questions comparing branded and generic products. While none of the answers were statistically significant, again Price buyers tended to be more favorable towards generic products compared with other segments. We did not ask the brand questions for feed; assuming that in the commercial agriculture sector feed is primarily a commodity.

Distribution and Loyalty to Local Suppliers

Producers can have strong preferences about the types of suppliers and differing levels of loyalty to those suppliers. To assess whether or not loyalty to local suppliers varies across market segments, respondents evaluated a series of statements about local suppliers on a five-point Likert scale with 1 representing strongly disagree and 5 representing strongly agree. To test for differences across segments, participants that responded either 4 or 5 on the Likert scale were grouped and their percentage of all the total respondents was reported in Table 9. The Pearson chi-square test statistic for no association is also reported.

Table 9. Respondent Attitudes towards Local Suppliers and Distribution by Product by Market Segment

Purchasing Decision Influences	Balance	Price	Performance	Convenience	χ^2 Statistic¹
Seed					
I consider myself loyal to my primary local supplier of seed	58.0%	44.1%	60.8%	65.1%	11.46***
In the next five years, I want a more direct relationship with seed companies	34.5%	40.7%	43.8%	39.5%	5.11
I prefer to buy most of the expendable items from one supplier	34.3%	33.1%	28.1%	38.4%	3.08
I am willing to pay slightly more to buy my inputs from locally owned suppliers	61.4%	52.5%	54.2%	64.0%	5.56
I often know more about many inputs products than my local supplier	31.5%	38.1%	37.9%	32.6%	3.36
Crop Protection Chemicals					
I consider myself loyal to my primary local supplier of crop protection chemicals	58.7%	40.9%	50.4%	71.4%	25.98***
In the next five years, I want a more direct relationship with manufacturers of crop protection chemicals	33.1%	38.3%	36.6%	36.3%	1.74
I prefer to buy most of the expendable items from one supplier	35.9%	25.3%	28.5%	45.1%	12.63***
I am willing to pay slightly more to buy my inputs from locally owned suppliers	62.0%	53.9%	52.8%	63.7%	6.21
I often know more about many inputs products than my local supplier	33.5%	37.0%	30.9%	30.8%	1.53
Animal Health					
I consider myself loyal to my primary local supplier of animal health products	55.8%	50.0%	60.0%		1.18
I prefer to buy most of the expendable items I need from one supplier	41.1%	30.0%	35.7%		2.18
I am willing to pay slightly more to buy my inputs from locally owned suppliers	58.3%	50.0%	61.4%		1.63
I often know more about many inputs products than my local supplier	36.2%	48.0%	47.1%		3.66
Feed					
I prefer to buy most of the expendable items I need from one supplier	34.8%	32.1%	45.9%		2.99
I am willing to pay slightly more to buy my inputs from locally owned suppliers	60.4%	51.8%	55.7%		1.38
I often know more about many inputs products than my local supplier	37.2%	48.2%	59.0%		9.06***

¹Pearson chi-square statistic and its significance where *, **, *** represent 0.10, 0.05, and 0.01 levels of statistical significance, respectively.

For both seed and chemicals, there were significant differences between market segments in loyalty to local suppliers. Convenience buyers were the most loyal to their local supplier and Price buyers were the least loyal to local suppliers. Balance buyers were also loyal to local suppliers for both seed and chemicals. Performance buyers were somewhat loyal and were more loyal to local suppliers of seed than local suppliers of chemicals. For animal health products, while there were no significant differences between market segments, Price buyers were, again,

the least loyal to local suppliers and Performance buyers were the most loyal. We did not ask this question for feed.

Crop producers were asked if they wanted a more direct relationship with seed companies and chemical companies. Overall interest in a direct relationship with seed and chemical companies was relatively low with between 33% and 44% of the producers in a market segment reporting that they were somewhat or definitely interested in a more direct relationship and there were no significant differences between market segments. That said, Price and Performance buyers were slightly more likely to want a direct relationship with seed and chemical companies.

For chemicals, Convenience and Balance buyers were significantly more likely than Price and Performance buyers to prefer to buy all of their chemicals from one supplier. For feed, Performance buyers were significantly more likely to say that they know more about the inputs they purchase than their local supplier than were other segments. We did not ask the supplier loyalty question for feed.

Price

To assess producers' price sensitivity, respondents were instructed to respond whether they tend to purchase the lowest priced products on a five-point Likert scale with 1 representing *strongly disagree* and 5 representing *strongly agree*. To test for differences across segments, participants that responded either 4 or 5 on the Likert scale were grouped and their percentage of all the total respondents is reported in Table 10. The Pearson chi-square test statistic for no association is also reported.

Overall, producers were the least price sensitive with regards to purchasing seed relative to chemicals and animal health products. For seed, chemicals, and animal health products, there were significant differences between market segments in terms of their price sensitivity. For seed, Convenience buyers (20.9%), followed by Price buyers (17.8%) were the most likely to report they purchased the lowest priced seed, while Performance buyers (6.5%) were the least likely. For both chemicals and animal health products, Price buyers (40.9% and 40.0%) were the most likely to agree they usually purchase the lowest priced products, followed by Performance buyers (23.6% and 27.1%) who were noticeably less price sensitive.

Producers may have different views of prices when it comes to the suppliers of products. For both seed and chemicals, there are statistically significant differences in producers' perceptions of the differences in prices among local suppliers. Performance buyers are the most likely to notice significant price differences, followed by Price buyers, with Balance and Convenience buyers being less likely to notice price differences. For both animal health and feed, while the differences between market segments are not statistically significant, Price buyers for both animal health products and feed, as well as Performance buyers for animal health products, are very likely to notice price differences between suppliers. One explanation for the price sensitivity of Performance buyers is that they tend to purchase more expensive products so they may expend more effort to find the least cost supplier of these products.

Table 10. Respondent Attitudes towards Price by Product by Market Segment

Price Sensitivity	Balance	Price	Performance	Convenience	χ^2 Statistic ¹
Seed					
When buying seed, I usually purchase the lowest priced products	9.8%	17.8%	6.5%	20.9%	17.21***
For expendable items, there are often significant price differences for similar products from one local supplier to another	38.2%	45.8%	49%	34.9%	8.17**
Crop Protection Chemicals					
When buying crop protection chemicals, I usually purchase the lowest price products	19.1%	40.9%	23.6%	16.5%	33.81***
For expendable items there are often significant price differences for similar products from one local supplier to another	39.4%	46.1%	48.0%	29.7 %	9.46**
Animal Health					
When buying animal health items, I usually purchase the lowest priced products	23.9%	40.0%	27.1%		4.96*
For expendable items, there are often significant price differences for similar products from one local supplier to another	34.4%	44.0%	44.3%		2.81
Feed					
For expendable items, there are often significant price differences for similar products from one local supplier to another	35.4%	42.9%	36.1%		1.04

¹Pearson chi-square statistic and its significance where *, **, *** represent 0.10, 0.05, and 0.01 levels of statistical significance, respectively.

Market Segment Comparisons

Input suppliers often sell multiple products. Since it is costly to develop product-specific marketing plans, one obvious question is how much overlap is there between market segments for these expendable products? Overall, 72.0% of crop producers have the same buying behavior for both seeds and chemicals and 70.1% of livestock producers have the same buying behavior for animal health and feed products. Furthermore, the Pearson chi-square test for no association showed very strong correlations between product categories in both the crop and the livestock input market segments, which suggests that suppliers can leverage their market strategies across product categories. For crop input suppliers, Table 11 presents producers' membership in chemical market segments given their buying behavior for seeds. For livestock input suppliers, Table 12 presents producers' membership in animal health market segments given their buying behavior for feed.

For crop input suppliers, there is a strong overlap in buying behaviors between seed and chemicals. If a producer is a Balance buyer for seed, then there is an 80.4% likelihood he or she is also a Balance buyer for chemicals. If a producer is a Price buyer for seed, then there is a 60.0% likelihood he or she is also a Price buyer for chemicals and a 27% likelihood of being a Balance buyer. If a producer is a Performance buyer for seed, then there is a 59.6% likelihood of also being a Performance buyer for chemicals, with 19.9% likelihood of being a Balance buyer and 17.2% chance of being a Price buyer. If a producer is a Convenience buyer for seed, there is a

60.2% likelihood of also being a Convenience buyer for chemicals with a 27.7% chance of being a Balance buyer.

Table 11. Overlap in Membership Seed and Crop Protection Market Segments

Crop Protection Market Segments	Seed Market Segments				χ^2 Statistic ¹
	Balance	Price	Performance	Convenience	
Balance	80.4%	27%	19.9%	27.7%	
Price	9.7%	60.0%	17.2%	10.8%	729.87***
Performance	4.6%	7.0%	59.6%	1.2%	
Convenience	5.2%	6.1%	3.3%	60.2%	

¹Pearson chi-square statistic and its significance where *, **, *** represent 0.10, 0.05, and 0.01 levels of statistical significance, respectively.

For livestock input suppliers, there is a strong relationship between membership in a feed market segment and the equivalent animal health market segment. Again, the strongest relationship is for the Balance segment. If a producer is a Balance buyer for feed, then there is a 77.9% likelihood he or she is also a Balance buyer for animal health. If a producer is a Price buyer for feed, then there is a 54.7% likelihood he or she is also a Price buyer for animal health and a 26.4% likelihood of being a Balance buyer. If a producer is a Performance buyer for feed, then there is a 63.2% likelihood of also being a Performance buyer for animal health, with 26.3% likelihood of being a Balance buyer.

Table 12. Overlap in Membership in Animal Health and Feed Market Segments

Animal Health Market Segments	Feed Market Segments			χ^2 Statistic ¹
	Balance	Price	Performance	
Balance	77.9%	26.4%	26.3%	
Price	7.8%	54.7%	10.5%	120.95***
Performance	14.3%	18.9%	63.2%	

¹Pearson chi-square statistic and its significance where *, **, *** represent 0.10, 0.05, and 0.01 levels of statistical significance, respectively.

Conclusion

The market place for expendable agricultural inputs is rapidly changing. With fewer farms making larger purchases, acquiring and retaining customers is of the utmost importance to agricultural input suppliers. This paper conducted a segmentation study on U.S. commercial producers for four expendable items: seed, crop protection, animal health products, and feed. For crop protection products and seed, four market segments were identified: Balance, Price, Performance, and Convenience segments. For animal health and feed products, three market segments were identified: Balance, Price, and Performance segments. Each of these segments were examined for differences in demographic and attitudinal characteristics.

For all four expendable products, the Balance segment defined the typical producer that considered all of the input supplier criteria (convenience/ location, customer service, price, performance, and support service) to be equally important. Since the Balance segment is the largest market segment, input suppliers and retailers must serve this segment. To compete for the Balance segment's business, the supplier must be competitive with other suppliers on convenience/location, customer service, price, performance, and support service. The default assumption is that all customers are Balance buyers until they demonstrate a strong interest in convenience, product performance or price.

The Convenience segment, for crop protection products and seed, was comprised of older producers who generally were more loyal to local suppliers and specific brands. The Convenience segment is the smallest segment and so input suppliers should consider whether they should develop a marketing program targeted to this segment, or alternatively offer the Convenience segment the marketing program developed for the Balance segment. Future research might consider whether there is a relationship between membership in the Convenience segment and purchase of services like application that would make this segment more attractive to serve.

The Performance segment, which is most interested in product effectiveness, was the least convinced that different brands for expendable items are more or less the same. They were also much more skeptical of generic labeled brands than some of the other segments. Understanding the trade-offs between brand loyalty and willingness to pay, given various information sources in the decision process, is an important area for future study of this segment and others.

The Price segment generally thought the trade-off between price and performance was good for expendable items. Price segment members were also much more involved in the decision making process as they preferred to make more decisions with little input from others than the other market segments. Using these and other characteristics input suppliers can begin to customize their marketing strategy to the various market segments.

There are several implications for managers that are clear from this analysis. First, for seed and crop protection sellers, it is worth noting that the large number of Balance buyers makes this segment an attractive opportunity. One aspect of this segment that is unique compared to others, is that this segment still places some value on support services. Marketers who wish to target that segment may want to be sure that those services are part of their offering. For example, in support of a strategy that targets Balance buyers, agronomy oriented retailers may wish to empha-

size their expertise in crop planning and analysis by including these capabilities in advertising and mailings.

Next, there is clearly a segment of buyers who prioritize performance over almost everything else, and performance is also the most valued aspect of the offering for Balance buyers. As marketers develop messages for the value they create, performance should take a prominent role unless there are other compelling reasons to emphasize other company strengths. For example, milk replacement marketers who target dairies who are Balance buyers may want their messages to emphasize recognizable high performing products while demonstrating how their expertise of matching those products to the needs of the operator results in higher production outputs.

Third, marketers may find efficiencies in marketing seed and crop protection together. While combining these products into a single package may not be attractive to all buyers, the buying differences between the two products are similar enough between the products, that a common segmentation strategy should be considered. Organizing supplier marketing efforts around segments of customers, rather than product lines, may provide a more efficient and effective means of allocating resources.

Finally, it is worth noting that many buyers consider themselves to be loyal to local retailers, and that translates into willingness to pay more for expendables. Local managers should not underestimate the value they create for seed and crop protection products. Neither should they rest in their effort to innovate services, which are valued less by some buyers. Marketers should leverage the strength of the relationship, by training sales and support staff to excel at matching seed and crop protection products with customer needs.

In some ways the livestock industry leads the crop industry in terms of consolidating segments. While the Convenience segment is small within crop input markets, this segment does not exist within the livestock industry. That said, convenience still weighs heavily for Balance buyers, who make up the largest segment. Marketers who don't possess a product or price advantage still have opportunities to emphasize a service component of their offering. Feed marketers in particular should consider enhancing the knowledge of staff in the field. This is an area where Performance buyers feel they often know more than the people who call on them. There may be an opportunity to capture market share with the Performance segment if firms emphasize this issue. Feed marketers who seek to market high performance feeds should be aware of this weakness as they build strategies for these product offerings.

Marketers of all expendable products should be cautious about creating a purely balanced approach to messaging across all buying motivations (price, product performance, service, and convenience). Particularly in areas where competition is stiff, suppliers risk losing their identity by trying to be all things to all buyers. It may be preferable to focus marketing messages on areas that are competitive strengths and then to tailor value propositions with individual customers to a more balanced value proposition through sales efforts. This may be most critical for suppliers who sell products like crop protection, which have potential for use across broad geographies and therefore have many competitors. Suppliers of products like seed, which may have limited suitability because of differing regional growing conditions, may benefit from emphasizing product performance. Future research may wish to consider the causal relationships between

cognitive perceptions of the value bundle and segment membership or decision making processes, particularly as it relates to mediating influences like veterinarians and agronomists.

One major contribution of the 2008 version of CAB's large commercial producer survey was that it enabled us to examine how market segments vary between expendable inputs. There was strong correlation found between memberships for animal health products and feed, and an even stronger correlation for crop protection products and seed. Market segment membership is relatively consistent across expendable items suggesting that an input retailer can develop buying behavior-based marketing strategies, rather than product-specific marketing strategies. Input suppliers need to recognize that while the majority of customers have a defined buying behavior regardless of the product, a sizeable number shift their buying behavior depending on the product.

This paper is a companion to Roucan-Kane et al. (2011) which used the 2008 Large Commercial Producer survey to identify market segments for capital equipment. In their review of the literature, Roucan-Kane et al. (2011) highlighted that the focus of the industrial marketing management literature is on how to segment markets and then once the market segments have been identified, how firms can use these segments to improve their marketing efforts. They also commented that the market segmentation literature in general does not offer insight as to why customers choose a particular buying behavior, which is a major shortcoming of the literature. One future direction for the Large Commercial Producer project is to examine the causal factors for producers' buying behaviors.

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