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Seed Market Segmentation: How Do Argentine Farmers Buy Their Expendable Inputs?

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Abstract

In this paper we analyze the buying behavior of farmers for expendable inputs. In particular, we will study the case of the seed industry in Argentina. We segment them using cluster analysis, identifying four distinctive segments of farmers for seed purchasing: Performance, Price, Balance, and Convenience. This work intends to help agribusiness managers understand customers in the seed market in Argentina. Additionally, a multinomial logit model is used to predict segment membership for seed purchases based on farmers' observable and attitudinal variables.

Keywords: expendable inputs, seed industry, Cluster analysis, Multinomial logit.

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Introduction

Agricultural input markets for products such as seeds, crop protection, and fertilizer are important markets in Argentina. Although it varies greatly from year to year, expendable input purchases by Argentine producers can amount for several billion dollars a year. Among them, the seed market is significant due to its size as well as its importance as a key input for farmers. The total formal seed market for major crops in Argentina was about one billion dollars in the year 2010. Additionally, there is an informal market, in which seed companies do not make profits (Appendix 1. Vilella et al. 2009; FIS 2000; CREA 2010).

The existence of an informal seed market in Argentina is due to the fact that there are some crops, such as soybeans and wheat, which are self-pollinated. For these crops farmers do not always pay for the seed they use, as they can save some from their last harvest. Only a fraction of the seeds sold in the market provides revenues to the seed companies: the seed sold in the legal market plus a system of payment called “extended royalties”. This would be the formal market; the rest of the seeds are sold in the informal market. For soybean the formal market was only 35 percent of the total market while for wheat it was around 50 percent in 2010, as we can observe in Annex I (USDA-FAS 2010; Goldsmith et al. 2003).

However, Argentine farmers are not a homogeneous group, nor buy seeds in the same way: They differ in terms of key dimensions such as farm size, educational background, age, location, land tenure, attitudes, risk management practices, technology adoption, and so forth. Grouping farmers by more homogeneous classes, in terms of segmenting farmers and defining their profiles are important issues for agricultural input companies in order to define their marketing strategies. In this paper we try to define how Argentine farmers buy their seeds for crops, segmenting these farmers in different classes with different purchasing profiles.

Marketing segmentation helps firms define particular marketing mix strategies that enable them to target customers with specific profiles and needs in each segment. This results from the fact that rarely customers in a particular market have exactly the same needs and expectations. By segmenting their customers companies can get closer to each customer by developing an appropriate marketing mix (Kotler1997).

Conceptually market segmentation can be defined as the process of subdividing the market into distinctive subsets of relevant customers that behave in the same way or have similar needs. Segmentation divides the heterogeneous market into relatively homogeneous groups in order to design a suitable marketing mix. The final goal of market segmentation is to find customers with different purchasing power and buying behavior, addressing the different needs of customers, and increasing the profit potential for the firm (Foedermayr and Diamantopulos 2008).

There are different stages in the market segmentation process, among which market definition, variable selection, and method decision are the most relevant from a normative perspective: How market segmentation ought to be conducted? The market definition is the first and one of the most crucial steps for its success. It should be defined integrating several dimensions, such as customer needs, competition, products and technologies (Danneels 1996).

Segmentation variables are the sets of characteristics that are used to assign customers to segments and indicate why segments differ. These variables can be classified into general or product specific, and also as observable or inferred. The general variables are independent of the product, while the product relates specifically to products and customers. Observable variables can be measured directly, as with demographic, economic or geographic variables. Inferred variables, on the contrary, are not directly observed, as the case of psychographics, perceptions, values and attitudes (Steenkamp and TerHofstede 2002).

Previous work has been done to segment farmers buying agricultural inputs, especially for the US (Hooper 1994; Bernhardt et al. 1996; Gloy and Akridge 1999; Foley 2003; Alexander et al. 2005; Reimer et al. 2009).

Gloy and Akridge (1999) identified four market segments for commercial farmers (producers with sales above 100,000US\$ a year) in the US: Balance, Convenience, Performance and Price. Balance farmers weighed the various purchasing factors evenly when selecting an input supplier. They found that the Balance farmers were the largest segment and the most sophisticated users of technologies such as computers and Internet. When making purchasing decisions of agricultural inputs, they were the most reliant on off-farm sources of information such as local dealers and local sales representatives. Balance-oriented farmers showed the least agreement with the statement that generic products represent a good trade-off between price and quality, and were also heavy users of custom application services.

On the other hand, the Convenience segment was the smallest, and placed a great deal of importance on convenience and location factors when selecting an inputs supplier. They tended to be the older farmers and were the most likely to not own computers. However, when they used computers for purposes such as financial record keeping and communicating, they did so at a low rate. They preferred to buy products from one supplier and were willing to pay more to buy from the locally owned providers. This segment tends to be the least reliant on off farm sources, except for local dealers on which they relied heavily. Regarding brands, Convenience members showed the least disagreement with the statement that there were no differences across brands.

Price buyers were the second largest segment and placed a great deal of weight on price factors when selecting an input supplier. They tended to be the largest farmers and most of them owned their computers. Regarding their off farm sources of information, the local dealer scored relatively low for these producers. They also tended to agree the most strongly that they planned to increase their usage of generic products in the future. Price buyers also were the most likely to agree that they always purchased the lowest priced expendable and capital goods. These farmers were the least likely to purchase from one input supplier.

Finally, the Performance-oriented farmers were those who focused on the performance of the products that they bought. In this segment were the most educated producers, in terms of years of college. These producers disagreed the most strongly that there were no differences across brands, as they believed that brands were not the same across products. They were unlikely to purchase only on the basis of price, and required technical competence from the sales representative.

Alexander et al. (2005) studied the purchasing behavior of US crop and livestock farmers with annual sales greater than 100,000 dollars. They used cluster analysis to identify five distinctive market segments for expendable inputs: These segments are Balance, Performance, Price, Convenience and Service. While Balance and Performance farmers can be categorized as business buyers, producers in the Price segment can be defined as economic buyers. Convenience and Service producers, on the other hand, can be considered as relational buyers. A business buyer is the person who purchases a good based less on cost and more on the productivity of the input. An economic buyer, in contrast, is the one that buys primary on price intending to reduce the input cost. A relational buyer would be someone that buys from the person he knows and trusts, and usually values services highly.

The Balance segment was the largest segment in Alexander et al. (2005), followed by Price, Service, Performance, and Convenience as the smallest. Convenience purchasers tended to be the oldest farmers, focused mainly on convenience/location purchasing factors. This segment contained the smallest operations in terms of gross sales, and had the least ambitious growth plans. On the other hand, the Service segment placed the most weight on service/information and personal factors when selecting an input supplier. The members of this segment operated the largest farms, in terms of gross sales, and had the lowest percentage of college graduates.

While the Price segment was the one with the least product loyalty, the Service segment was the most loyal. Regarding information sources, the Performance segment was the most information intensive, in terms of usage of computers and Internet, and producers in the Convenience segment were the least likely to own or use a computer. Balance and Performance buyers were the heaviest users of consultants and custom services, while Price purchasers had the lowest overall use of customer services and relatively low usage of consultants. Members of the Convenience segment were the least likely to use consultants.

These authors concluded that the Convenience segment was rapidly declining in the US. They also identified a second group of relational buyers, the Service segment, which was growing in size. The difference they found between Convenience and Service producers is that while for Convenience buyers their relationship with the salesperson had an intrinsic value, for the Service segment the relationship with the salesperson was valued due to the technical information and expertise offered.

A multinomial regression was also introduced by Alexander et al. (2005) to predict segment membership, concluding that the two variables providing the most predictive power were whether a producer had a college degree, and the number of consultants hired by the farmer: If a farmer would have a college degree he is 4 percent more likely to belong to the Price Segment, and 7 percent less likely to belong to the Service segment. And for each consultant hired the farmer is 3.5 percent more likely to be in the Balance segment, two percent less likely to be in the Price segment and 3 percent less likely to be in the Convenience segment.

The segmentation approach used in the present work is similar to Alexander et al. (2005). It is normatively oriented, intending to explain how segmentation should be conducted rather than how segmentation is actually performed in practice. It also employs a descriptive rather than predictive perspective, as it is aimed to establish relationships between purchasing variables and

different types of producers without distinguishing independent and dependent variables. As well as Alexander et al. (2005), the analytical tools used in this work are cluster analysis to identify purchasing behavior, and a multinomial regression to predict segment membership.

Accordingly, the problem we want to study is how Argentine farmers buy their seed inputs, and how to segment these producers in order to understand better their purchasing behavior for seeds. We will restrict the study to Argentine farmers in the geographic area of the 'Humid Pampa' (which is equivalent to the US Corn Belt) that produce more than 750 tons of soybeans a year.

In this way, the main goal of this paper is to identify distinctive market segments for Argentine farmers purchasing seeds. The idea is to segment farmers into buying characteristics according to their purchasing behavior, and to be able to predict farmers' segment membership. This will help us to answer questions regarding the factors that allow farmers to be segmented, which may signal the need for alternative marketing strategies.

Data

The data we used to segment the farmers' input markets is based on the survey "The Need of Argentine Farmers", done in the second half of the year 2009 by the Center for Food and Agribusiness of the Austral University in Argentina, with the partnership of Purdue University in the US. This survey was done between August 17th and September 17th 2009 by a team of qualified interviewers, through personal interviews to farm operators responsible for the farmers they manage. The questionnaire had 37 questions, and took around 60 minutes to answer. Only one question was open-ended, 29 were closed questions, and seven were semi-structured questions.

The population under study was farmers in the main agricultural area of Argentina ("Humid Pampa") which produce 750 or more annual tons in soybeans, in order to target producers with a minimum scale to be considered professional farmers. Surveyed producers were heads of farms (owned or leased properties) in which 70% of their income came from soybeans and the rest from other crops.

This area covers the provinces of Santa Fe, Córdoba and Buenos Aires. It includes the counties in which the sowing area represents more than 10% of the total production area. The total population includes 7,400 producers, who produce 70% of the total soybean in the main crop area of Argentina.

The sample formed by 502 farmers responsible of farms with owned or rented land was drawn from a database containing information on location and enterprise. The sample size was obtained by proportionally stratifying method to the amount of farms per province with a degree of statistical confidence of 95%.

Methodology

The two methodological tools we used in this work are cluster analysis and a multinomial logit model. Following Gloy and Akridge (1999) and Alexander et al. (2005), we used cluster analysis to segment the seed input markets. The goal of cluster analysis is to divide a data set into different groups or clusters, based on buyer characteristics and buyer behaviors, so that the

characteristics and behaviors of the individuals in a group/cluster are as similar as possible to each other and as dissimilar as possible to the observations in other groups/clusters.

According to Aldenderfer and Blashfield (1984) there are five basic steps that characterize all cluster analysis studies:

1. Selection of a sample to be clustered;
2. Definition of a set of variables on which to measure the entities in the sample;
3. Computation of the similarities among the entities;
4. Use of a cluster analysis method to create groups of similar entities;
5. Validation of the resulting cluster solution.

In a cluster-based segmentation we first have to select the sampled data, which in our case are the 502 Argentine farmers in the Humid Pampa region producing more than 750 tons of soybeans a year, as we explained in the previous section. Then, identify the key variables that ought to characterize the purchasing behavior of Argentine farmers for seeds. As in Alexander et al. (2005), the key question used in the segmentation analysis asked farmers to weigh the influence of six factors when purchasing their agricultural inputs. The influence of these factors had to sum up 100%.

The question was stated as follows: *“When you choose a supplier for the following categories of input products (seeds, crop protection, fertilizers, machinery, and financial services), how is your decision influenced by the following factors? Assign a percentage value to each value to each factor based on its importance in the decision.”*

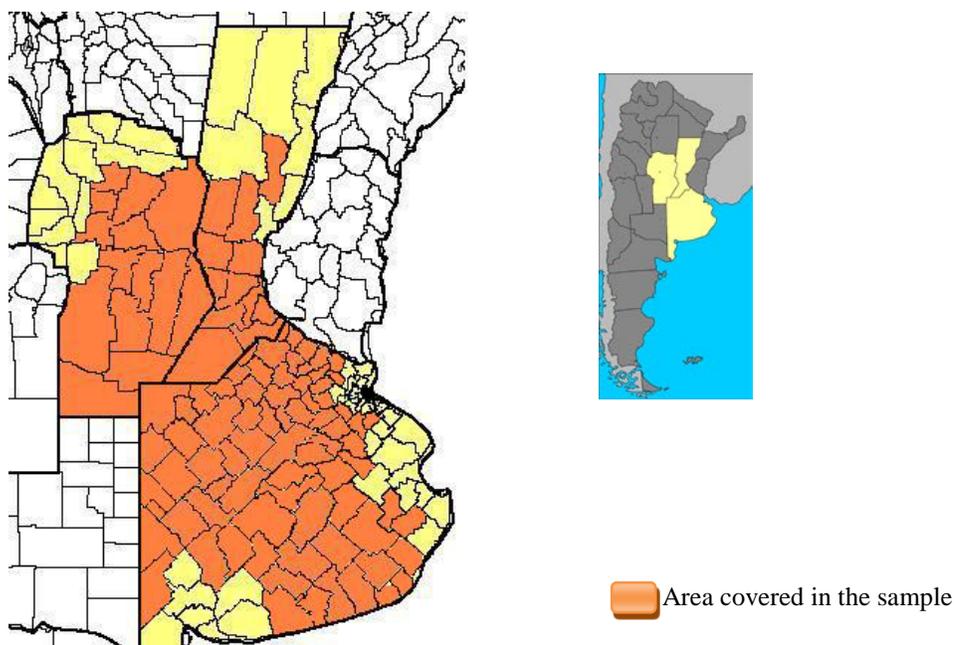


Figure 1. Area Covered in the Sample

The factors included were convenience/location, customer services/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).

Next, the data on these variables was processed in order to place respondents with similar answers in the same segment/group or cluster. The idea is that through cluster analysis we can group observations in such a way that there will be a higher level of natural association between group members than those that are not.

What follows is to define the cluster analysis method to be used. The two main cluster analysis methods to create groups of similar entities are the hierarchical and non-hierarchical (or partitioning) clustering methods.

Hierarchical clustering involves creating clusters that are hierarchically nested within clusters at earlier iterations, in that each cluster can be included as a member of a larger, more comprehensive cluster at a higher level of similarity. The most familiar expression of the results of hierarchical clustering methods is the tree diagram or 'dendrogram', which shows graphically the hierarchical structure entailed by the similarity matrix and clustered by the linkage rule. Among agglomerative hierarchical methods, we have the Ward Method. This procedure is designed to optimize the minimum variance within clusters, and it works by joining those groups or clusters that result in the minimum increase in the variance. (Aldenderfer and Blashfield 1984)

Non-hierarchical clustering, on the other hand, are methods that divide a data set into a number of clusters by trying to minimize some defined error function. Partitioning clustering methods do not depend on previously found clusters. These methods work directly upon the raw data, therefore offer the opportunity of handling distinctly larger data sets than hierarchical methods. As they make more than one pass through the data and can compensate for a poor initial partition of the data, thereby avoiding one of the major drawbacks of hierarchical agglomerative methods. Partitioning clustering methods, however, suffer from some drawbacks, as they posit explicit assumptions about the shape of the clusters; calls for an initial guess at the number of clusters that will eventually be found; and are influenced by the choice of initial seeds, the presence of outliers, and by the order in which the seeds are observed and analyzed. (Aldenderfer and Blashfield 1984)

As previous authors have done (Gloy and Akridge, 1999; Alexander et al., 2005), we will first used a Ward hierarchical clustering method to identify the number of clusters and to get the starting points (seed values) for a second non-hierarchical algorithm procedure, which is the k-means technique. This second algorithm rearranges the results optimally given the previous results about the cluster means.

To validate the number cluster we used three criteria: the pseudo F statistical value, the cubic clustering criterion (CCC) and the R^2 test. The Pseudo F-value is used to compare variability obtained with K and K+1 groups or clusters, evaluating the relative reduction of variability as we add new clusters. The higher the F value, the higher the variability reduction that is obtained as we add one additional cluster. The cubic clustering criterion (CCC), establishes a comparative

measure of the deviation of the segments regarding the expected distribution if the observations would have been obtained from a uniform distribution. A value above two would suggest that the structure of the clusters would be good; a value of zero to two would suggest not a very clear structure of a cluster. The negative values of the CCC criteria would be attributed to the presence of out-layers. Finally we have the R^2 test, as the proportion of variance explained by the observations belonging to the conglomerate, the higher its value the better the conglomerate.

Finally, we validated the segmentation through tests of significance differences between the groups' responses to non-clustering variables (Gloy and Akridge 1999). After clusters were identified, chi-square tests of no association were run on the non-clustering categorical variables to examine differences in segment characteristics and attitudes. Statistical significance of mean responses between the clusters for each continuous variable was calculated using an F-test.

Similar to Alexander et al. (2005) we used a 'multinomial logit model' to predict segment membership for seed purchases by Argentine farmers based on observable factors and business management attitudes. Each producer can only belong to one segment, and each buying behavior segment is distinct and unordered. The multinomial logit is a probability model that explains the odds ratio of belonging to a certain cluster if an observable behavior or characteristic of a farmer is present (Gujarati, 2003).

The cluster results were developed by using various routines in SAS 9.0 (SAS Institute, Inc. 1989). For example, the hierarchical clustering (Ward's algorithm) was implemented with the CLUSTER procedure, and the k-means clustering algorithm was implemented with the FASTCLUS procedure. The chi-square test was calculated with the option "chisq" in the FREQ procedure and the F-test was implemented with the ANOVA procedure. To the multinomial logit analysis we used the MLOGIT procedure in Stata 10.0. (SPSS 10.0 Syntax Reference Guide, SPSS Inc. 1999).

In the next sections we will present the result of our cluster analysis. In the first section we present the segmentation of farmers in different clusters, as we shall see in Table 1. In the next part, we introduce the description of farmers in each of these segments by non-clustering variables, as described in Tables 2 to 6. Finally, in the last section, we present the logit multinomial regression used to predict segment membership, presented in Table 7.

Results

Based on the two steps clustering procedures, and using the validation criteria, we identified four natural clusters according to their seed buying behavior. Table 1 presents the means percentage and the names of each cluster based on the most influential factor in the supplier choice.

Characteristics of Segments

The Performance segment is the largest cluster, with 37 percent of the respondents. Members of this cluster search for high quality products and services. On average, the members of this segment placed 77 percent weight on product that perform well and only 11 percent on price.

Performance members weighted the other factors (convenience/location, service/information, personal factors, and support services) between 2 to 4 percent each. Table 1 shows that producers in this segment placed much more weight on performance than farmers in other segments; and less for price, personal factors, convenience/location and services and information. Thus, Performance farmers are not interested in working relationships when choosing suppliers; and related services and information were relatively unimportant for them. They were mainly focused on purchasing products that perform well, not caring too much about price nor services, information, convenience and location factors.

The Price and Balance segments were, respectively, 28 and 29 percent of the marketplace. Members of the Price segment placed emphasis on competitive price (48 percent) which would mean that these farmers are cost-oriented: they buy their seed at a lowest price. In spite of this, performance is the second most important factor with a weight of 34 percent, and these two factors account for 82 percent of the total weight of purchasing factors. Other factors (convenience/location, service/information, personal factors, and support services) were ranked low by these farmers, similar to the case of Performance producers. Price oriented farmers were those who were interested in buying their inputs at the lowest price for products that performed reasonably well.

In the Balance cluster, farmers valued all factors fairly equal but gave special importance to performance and price: 22% and 23%, respectively. Services and information, as well as personal factors were also important factors to this segment with 18% each. Farmers in the Balance segment ranked higher than producers in other segments 'service and information', 'personal factors', as well as 'support services'. Farmers in this segment were looking for input suppliers who would be able to supply a large array services and information, at a reasonable price, and with products that perform well.

Table 1. Seed Industry Segmentation: Mean Percent Importance of Each Purchasing Factor

<i>Factors/Segments</i>	Performance	Price	Balance	Convenience
Convenience/Location	2	4	8	60
Service/Information	4	5	18	8
Personal factors	2	5	18	5
Price	11	48	23	13
Performance	77	34	22	6
Support Services	4	5	10	7
Frequency	188	147	142	25
Percentage of the Sample	37	29	28	5

The smallest cluster is Convenience, with only 5 percent of the sample. Members of this segment placed a large emphasis, roughly 60 percent of their weight, on 'convenience and location', provided by a seed supplier. The rest of the factors had a lower weight: 13 percent for price,

eight percent for service and information, seven percent for support services, five percent for personal factors and only six percent to performance. These farmers were the only ones focused mainly on convenience and location, without much regard for 'performance' nor 'service/information', 'personal factors' or 'support services'. Prices paid for their inputs were also relatively unimportant.

This gives us a general profile of farmers in each cluster. To help suppliers assess which segment represents the best target market, the segments were examined with respect to many of the factors that characterize the decision makers and their farm business and the product /service/information mix that they are likely to desire. In the next section we will analyze the demographics and general business characteristics, and the commercial attitudes of farmers in these groups.

Demographics and General Business Characteristics

The demographic and general characteristics considered were education, age, farm size, total sales and future growth. These characteristics are generally observable and assist marketers in building a demographic profile of the segments. The results show that the differences in education, age, farm size and future growth among the four segments were not statistically significant (Annex II). Minhas and Jacobs (1996) found that market segmentations based on customer characteristics are poor predictors of future buying behavior in the financial services market, so the behavior segmentation proved to have much better predictive power.

The producers sampled were relatively young with an average age of 46.5 years (with standard deviation of 11.6 years), and almost half of them had a college degree (46 percent). More than half of the producers had a farm size less than 600 hectares and the expected percent growth in size was 32.5 percent (with standard deviation of 112.7%).

Balance farmers were relatively large, and 46 percent of them earned more than half a million dollars. On the other hand, Convenience farmers were relatively small in terms of farm size. This segment contained 60 percent of their operations between 200 thousand and half a million dollars but only 4 percent had income less than 200 thousand dollars (Annex II).

Table 2. Commercial Attitudes

	Segments				Prob. of no association
	Performance	Price	Balance	Convenience	
Brands are more or less similar for seeds	2.05	2.38	2.32	2.72	0.155
Brand loyalty for seeds	3.72	3.46	3.49	3.36	0.182
I purchase seeds at the lowest price	1.62	2.07	1.79	2.08	0.017**
Loyalty with the local dealer	3.76	3.45	3.55	3.68	0.057*

Notes. Single, double and triple asterisk(*) denote statistical significance at the 0.10, 0.05 and 0.01 level respectively. (Likert scale from 1 to 5; 1=I Strongly Disagree, 5= I Strongly Agree)

Commercial Attitudes of Farmers in Each Segment

Farmers can choose their seed inputs with different quality, prices, and brands; they also can buy them from different suppliers. In order to assess how farmers perceive brands, prices and suppliers, respondents were asked to signify their level of agreement regarding different statements measured on a five point Likert type scale, in which a 5 would mean “I strongly agree” and a 1 “I strongly disagree”. An answer of 3 would convey some neutral standing regarding the statement. The average responses for farmers in different segments are presented in Table 2, along with the probability of no differences in response across the segments.

The perception of farmers regarding seed brands was similar across segments: All segments agreed with the statement that brands were not similar (average of 2.37); and they all strongly agreed with the statement that farmers were loyal to seed brands (average of 3.51). Thus, while segments do not show statistical differences regarding the perception of brands, they all considered themselves loyal to them.

Producers in all segments disagreed with the statement that said that they usually purchased seeds at the lowest price; however, farmers showed statistical differences across segments regarding this issue. Farmers in the Performance segment disagreed the most, followed by the Balance purchasers, while members of the Convenience and Price segments only weakly disagreed.

In contrast, all clusters strongly agreed that they were loyal with local dealers; but some did so more firmly than others. Performance was the most loyal segment, while the Price segment showed to be the least loyal among all clusters. These differences across segments were statistical significant, as we can see in the last column of Table 2.

The management implication regarding the commercial attitudes of farmers is that the Performance buyers were the most attractive group for seed input firms, in terms of price sensibility and loyalty to local dealers. Those in the Price segment were the least attractive regarding price sensibility and loyalty with local dealers, while Convenience farmers were not attractive from the pricing perspective. Regarding branding strategies, there was no difference among segments. However, branding is an important issue that seed firms must consider when selling their products in Argentine.

Information Sources

According to how customers value their information sources, input firms can design different commercial strategies. These sources can be more personally oriented, such as the manufacturer salesperson or other farmers; or communication media oriented, for instance the agricultural section of newspapers. In this section respondents were asked to evaluate how often they obtained useful information from the following sources on a five point Likert type scale, in which a 1 would mean “I never use it” and a 5 “I always use it”. The average responses for farmers in different segments are presented in Table 3, along with the probability of no differences in response across the segments.

Table 3. Useful Information Sources

	Segments				<i>Prob. of no association</i>
	<i>Performance</i>	<i>Price</i>	<i>Balance</i>	<i>Convenience</i>	
Manufacturers salesperson	3.41	2.99	3.01	3.00	0.026**
Information local dealers	3.61	3.26	3.59	3.72	0.080*
Other producers	3.22	2.68	2.78	3.00	<0.001***
Meeting with suppliers	3.13	3.08	3.11	3.32	0.021**
Emails	3.43	2.96	2.89	3.40	<0.001***
Ag websites	3.11	2.91	2.82	3.60	0.032**
Ag section newspapers	3.22	2.98	3.27	3.40	0.075**

Notes. Single, double and triple asterisk(*) denote statistical significance at the 0.10, 0.05 and 0.01 level respectively. (Likert scale from 1 to 5; 1=I Strongly Disagree, 5= I Strongly Agree).

The results show strong significant differences between the segments in all items. What can be observed in Table 3 is that Performance buyers were the ones that tended to use more frequently sources such as ‘manufacturers salespersons’, ‘other producers’ and ‘emails’. Farmers in the Convenience segment used more frequently information obtained from ‘local dealers’, ‘meetings with suppliers’, ‘agricultural websites’, and the ‘agricultural section of newspapers’. On the other hand, Price and Balance oriented farmers tended to use less frequently these information sources that Performance and Convenience buyers.

The implications from this section are that Performance and Convenience buyers were the most intensive information users. They not only used personal information sources frequently to buy their inputs but also media sources such as agricultural web pages and the agricultural section of newspapers. Input firms would have to have strategies to address customers in these segments on the web, and also ways of delivering information from the personal channels for these buyers as well. However, it would be more difficult to tailor an information strategy for farmers in the Balance and Price segment, as they tended to use less frequently media and personal sources to make their purchases.

Table 4. Table Usage by Consultant

	Segments				<i>Prob. of no association</i>
	<i>Performance</i>	<i>Price</i>	<i>Balance</i>	<i>Convenience</i>	
Independent Crop Consultant	62	70	61	44	0.062*
Pest Control Consultant	34	31	28	20	0.481
Environmental Consultant	5	2	2	4	0.297
Management Consultant	14	19	22	20	0.354
Accountancy/tax Consultant	90	88	87	88	0.834
Financial Consultant	12	9	16	12	0.293

Notes. Single, double and triple asterisks (*) denote statistical significance at the 0.10, 0.05 and 0.01 level respectively. In percentage values per segment.

Consultant Usage by Farmers

Independent consultants provide useful information and advice to farmers. Farmers rely on consultants in specific areas in which they need their expertise. Respondents were asked if they currently use any of the following types of independent, paid consultants on their farms. The answers are shown on Table 4, in terms of the percentage of farmers that use consultants in different fields per segment.

The most used consultants were ‘the independent crop’ and ‘accountancy/tax’. However, only the use of independent crop consultant significantly differed among the four segments. The Price buyers were the ones who were more likely to use independent consultants (70 percent), while the Convenience purchasers were the least likely (44 percent).

These results suggest that ‘independent crop consultants’ might influence farmers’ seed purchases in the case they consult them frequently, which is especially the case for Price buyers.

Salespeople Characteristics and Activities Most Valued by Farmers

Salespeople are a key asset for input suppliers, by which they traditionally reach farmers and sell their products. In this section we address the issue of what are the characteristics and activities that salespeople perform that are most valued by farmers.

Regarding salespeople characteristics, respondents were told to think about the best agricultural salespeople they knew and asked to answer how important were some characteristics such as: ‘technical competence’, ‘honesty’, ‘knows your operations’, ‘represents your interests’, and ‘is a friend’. The results are shown in Table 5, in terms of the percentage of producers selecting each characteristic as one of the most important characteristic of a sales representative by segment.

Table 5. Salesperson most important characteristics by Segment

	Segments				Prob. of no association
	Performance	Price	Balance	Convenience	
Has a very high level of technical competence	49	44	32	52	0.014**
Is honest	29	29	35	32	0.645
Knows my operations well	11	10	18	14	0.154
Represents my interests	7	14	12	12	0.220
Is a friend	4	4	3	0	0.763

Notes. Single, double and triple asterisks (*) denote statistical significance at the 0.10, 0.05 and 0.01 level respectively. In percentage values per segment.

Technical competence’, ‘honesty’, and ‘knows my operations well’ were ranked as the most important characteristics by all farmers; while ‘represents my interests’ and ‘is a friend’ were not highly valued. The results in Table 5 indicate significant differences among purchasing segments only for the ‘technical competence’ characteristic. The Convenience buyers valued the most

‘technical competence’, followed by farmers in the Performance segments. On the other hand, the Balance segment valued this characteristic the least.

This would mean that input firms should train well their salespeople in the characteristics that farmers value most. In the case they sell products to the Performance buyers, they should take special care to train their salespeople in technical skills. On the other hand, selling to Balance-oriented farmers would require recruiting and training salespeople not only with technical skills but also concerned with being honest.

Regarding salespeople activities, respondents were ask rank the activities that salespeople perform, such as ‘calls by phone’, ‘provides good follow up services’ or ‘brings innovative ideas’. Results are show in Table 6, on a five point Likert type scale, in which a 5 would mean “Very important” and a 1 “Not important”.

All activities, except ‘Call me frequently by phone’ are highly valued. The most valued activity is ‘brings me the best prices’, in which Price purchasers value it the most. Also the Price segment perceives as important ‘provides good follow up services’ above other segments. The item ‘Provides relevant/timely information’ is also valued highly, but there are no significant differences among segments.

The business implications regarding salespeople characteristics and activities is that purchasing segments had significant different preferences. Suppliers have an opportunity to train their sales force to address these differences, focusing on the ones more relevant for each type of buyer. For instance, Convenience and Performance buyers would value the most technical competences, while the Balance segment value ‘honesty’ and ‘knowing well their operations’. Regarding salespeople activities, price purchasers would value ‘brings me the best price’ and ‘provides good follow up services’, and so on.

Table 6. Salesperson Activities Most Valued

	Segments				<i>Prob. of no association</i>
	<i>Performance</i>	<i>Price</i>	<i>Balance</i>	<i>Convenience</i>	
Call me frequently by phone	2.63	3.07	3.11	2.76	0.096*
Provides good follow up service	3.97	4.14	3.98	3.84	0.058*
Is a consultant for my business	3.40	3.41	3.30	3.44	0.156
Brings me innovative ideas	3.69	3.86	3.94	3.56	0.113
Provides relevant/timely information	4.12	4.15	4.11	3.84	0.362
Brings me the best prices	4.32	4.58	4.18	4.12	0.015*
Provides access to suppliers resources	3.77	3.65	3.53	3.56	0.640
He help me feel sure/confident about my purchasing decision	3.39	3.77	3.63	3.48	0.101

Notes. Single, double and triple asterisk(*) denote statistical significance at the 0.10, 0.05 and 0.01 level respectively. (Likert scale from 1 to 5; 1=I Strongly Disagree, 5= I Strongly Agree).

Predicting Segment Membership

Once market segments have been identified, and agribusiness managers develop marketing programs tailored to each segment, managers and salespeople face the challenge of identifying whom to target with each program in the future. In working with producers, salespeople can easily observe farm characteristics and collect additional information about the farm through simple questions. Using information that can be observed by salespeople, we employed a multinomial logit analysis to predict segment membership for the 502 respondents.

This is potentially useful for marketing managers because, observing characteristics and key behaviors of a client such as demography, sales, location, information sources and business management attitudes, they would be able to predict to which cluster that farmer belongs, and in this way, know what that person values most in his purchases.

Table 7 reports the marginal effects, which indicate the impact that each observable characteristic has on the probability that a customer will be a member of a specific buying behavior segment. A positive value of the marginal effect at observable characteristic would make a farmer belong to a certain cluster, while a negative value would make him member to another cluster. The marginal effect of the dummy variables is calculated as the discrete change in the expected value of the dependent variable as the dummy variable changes from 0 to 1.

The model χ^2 statistic (80.38 with 33 degrees of freedom) is significant at a level of 1% level of probability. Likewise, the predicted share for each cluster is consistent with the actual share in each one of the segments. In all the groups, except for the Price segment which has only two significant variables, there are at least three to five significant observable characteristics that supply significant statistical predictive power for each one of the cluster membership.

Table 7 shows that observable demographics variables are not relevant in order to predict segment membership, except for sales. Farms with higher total sales are 5 percent more likely to be in the Balance segment and 5.5 percent less likely to be in the Performance segment. These results are consistent with those of Annex II, in which it is shown that differences based on demographic characteristics are not statistically significant with the exception of sales volume. The information sources such as manufacturer salesperson, local dealer, email and agricultural websites provided substantial information about their input buying behavior, but there may be more difficult for a supplier to observe. However, a salesperson could easily ask a producer if he/she uses more frequently that source of information.

If the producer uses more frequently information obtained from manufacturer salespersons, then he/she is 5 percent more likely to be in the Performance segment, and if the producer tends to use more frequently information from Agricultural websites, then he/she is 2 percent more likely to be in the Convenience segment. These results are consistent with those presented in Table 3 regarding useful information sources.

Table 7. Results of a Multinomial Logit Model Predicting Segment Membership: Marginal Effects (with standard errors in parentheses)

<i>Variable</i>	Producer Segment			
	<i>Performance</i>	<i>Price</i>	<i>Balanced</i>	<i>Convenience</i>
Age	-0.0179 (0.021)	0.0213 (0.019)	0.0016 (0.019)	-0.0050 (0.006)
Sales	-0.0558 (0.032)*	-0.0022 (0.030)	0.0517 (0.030)*	0.0063 (0.01)
Education	-0.0208 (0.051)	-0.0334 (0.048)	0.0467 (0.047)	0.0076 (0.015)
Location	-0.0073 (0.03)	-0.0331 (0.029)	0.012 (0.028)	0.0283 (0.009)***
Manufacturer salesperson	0.048 (0.019)**	-0.0215 (0.017)	-0.0207 (0.018)	-0.0059 (0.006)
Local Dealer	0.0062 (0.02)	-0.0343 (0.018)*	-0.0246 (0.019)	0.0035 (0.006)
Emails	0.0701 (0.023)***	.0.0234 (0.021)	-0.0402 (0.021)*	-0.0065 (0.007)
Ag websites	-0.0271 (0.022)	0.0061 (0.021)	-0.0022 (0.021)	0.0187 (0.007)**
Brand similarity	-0.0491 (0.018)***	0.0242 (0.016)	0.0157 (0.017)	0.0092 (0.005)*
Brand loyalty	0.0385 (0.018)**	-0.0228 (0.016)	-0.0134 (0.016)	-0.0023 (0.005)
Salesperson offers best prices	-0.0177 (0.026)	0.0749 (0.027)***	-0.0487 (0.023)**	-0.0085 (0.007)
Predicted share	37.79%	29.65%	29.19%	3.36%
Real Share	37.45%	29.28%	28.28%	4.98%

$\chi^2=80.38^{***}$ (33 d.f.); Prob> $\chi^2<0.001$

Note. Single, double, and triple asterisks (*) denote statistical significance at the 0.10, 0.05, and 0.01 level respectively.

It also can be observed that if the producer obtains more frequently useful information from email, then he/she is 7 percent more likely to be in the Performance segment and 4 percent less likely to be a member of the Balance segment. This is coherent with the results presented in Table 3, in which Performance buyers tend to value email information more than other segments. Regarding brands, if a producer considers that brands are similar, then he/she is 5 percent less likely to be in the Performance segment and 1 percent more likely to be in the Convenience segment. Also, if a producer is loyal with brands, then he/she is 4 percent more likely to be in the Performance segment. The management implication is that the marketing manager of an input

firm should promote the product's brand especially to producers in the performance segment through local dealers, emails, and manufacturers' salesperson.

If the producer values highly to be offered by the salespersons the best prices, he/she is 7.5 percent more likely to be a member of the Price segment and 4.9 percent less likely to be a member of the Balance segment. This is consistent with the purchasing priorities of the Price segment, presented in Table 6. Thus, pricing strategies should be implemented for these segments by marketing managers in order to improve their performance.

Overall, the logit model has strong predictive power, which is shown by the significant relationships we explained above. Using this model to predict segment membership benefits the company if the customer classification is correct. The customer will be offered a tailored marketing mix matching his or her needs and wants, and the marketing literature has demonstrated that the tailored marketing approach builds customer loyalty and increases customer retention (Kotler 1997).

Conclusions

The main goal of this paper was to identify distinctive market segments for Argentine farmers purchasing seeds, by segmenting them according to their purchasing behavior. The overall goal was to provide some insights regarding Argentine producers' purchasing behavior for their seed inputs based on the information we collected from farmers.

Argentine farmers were partitioned into four clusters according to their seed buying behavior: Performance, Price, Balance, and Convenience segments. Farmers in the Performance and Balance segments would be business purchasers, as they purchase goods based less on cost and more on the productivity of the input. Farmers in the Price segment are cost-oriented or economic buyers as they buy primarily based on price intending to reduce the input cost. The Convenience farmers, on the other hand, are those who prioritize location and convenience for their purchases, without much regard for performance, nor services and information.

The second goal was to characterize farmers in each segment. The data indicated in Tables 2 to 6 fitted well with the different segments we have defined in this work. Regarding the Performance buyers, the largest segment, it has been established that farmers in this segment value the information coming from the manufacturer salespeople, other producers and emails. They are the most loyal buyers to local dealers and do not buy seed at the lowest price. These producers value the 'technical competence' from input salespeople.

The Price-oriented farmers belonging to this segment value getting from the salesperson the best prices and good follow up services. They are the second largest group and tend to be the highest users of crop consultant services. The Balance buyers, on the other hand, are the third largest group and have relatively low price sensitivity. They value, to some extent, the frequent calls from salespeople.

As in Alexander et al. (2005) the Convenience buyer is the smallest segment. Farmers in this segment demand a high level of technical competence from salespeople, and use relatively few

independent crop consultants. They are the second most loyal group to local dealers. They value information from local dealers and meetings with suppliers. They also consider valuable the information from agricultural websites, newspaper’s agricultural section, and emails.

In this way we were able to define a profile for each segment, which we summarize in the Table 8. There are several management implications from these results. Firstly, the largest and most attractive group is the Performance segment: they require high quality products, have high brand loyalty and low price sensitivity. However, they do not give too much value to services or the convenience/location factors.

Table 8. Summary of Important Tendencies by Seed Segments

Description/Traits	Performance	Price	Balance	Convenience
Demographics	The largest segment	Second largest group	Third largest segment	The smallest segment
	Importance of high quality products	Price-oriented buyers	Values all factors relatively equal	Values location/Convenience
Pricing	Not very price sensitive, lower than other segments		The second lowest in price sensitivity	Largest segment in sales volume
	The most loyal to local provider		Smallest segment in sales volume	
Relation with the local dealer	The most loyal to local provider		Second most loyal to local provider	
Personal Related Information Sources	The manufacturer salesperson and other producers are good information sources		Two main information sources are the local dealer and meeting with suppliers	
Media Related Information Sources	They consider emails valuable		They consider Ag websites and newspapers Ag sections valuable	
Consultants	The highest usage of crop consultants			
Salesperson Characteristics	The second highest requirement of technical competence		The highest requirement of technical competence	
Salesperson activities	High importance of ‘brings me the best prices’ and ‘provides good follow up services’		They place some value on salesperson’s frequent calls	

On the other hand, the Convenience producers are the smallest segment, with lower brand loyalty and higher price sensitivity, what turns them into a less interesting group to serve. This would mean that the Convenience segment is a niche market with small economic significance for marketers. The Balance group would be the second most attractive segment, as they are fairly large and have low price sensitivity.

These results also highlight the importance of brands in these markets, for producers in all segments: Input firms selling seeds in Argentina need to invest in brands in order to do well. Also, producers in all these segments tend to be loyal to local dealers, which turns them into important partners in this business.

Regarding the information sources, firms have to use an array of personal and media related sources to reach producers in Argentina, especially those in Performance and Convenience segments. The local dealers' information appears as a relevant source for all segments, while the manufacturer salespeople's information is relevant for Performance producers. Convenience farmers would be the ones who value most Ag websites, Ag sections of newspapers and meeting with suppliers.

Considering the firms' sales force, the results show that farmers in Argentina value their 'technical competence' more than any other characteristic. In no case 'friendship' is considered valuable for any of the segments. Regarding salesperson's activities, 'providing good follow up services' and 'offering good prices' appear to be the most valued activities, especially for Price-oriented buyers. All this would be important for firms to consider when training their sales force. Another goal was to be able to predict segment membership of farmers, which we did with a logit regression model. Farmers' observable characteristics such as age and education resulted to be poor predictors of future buying behavior by farmers, with the exception of sales volume. On the other hand, variables which were obtained through asking farmers (such as the usage of email as a useful source of information about farm inputs, brand similarities, or the salespeople's activities as offering the best prices) performed much better in order to predict segment membership.

In this way, for example, if a farmer has relatively low sales volume, uses more information obtained from manufacturer salesperson or emails, and is more brand-loyal, he/she would be more likely to belong to the Performance segment. This can be a useful tool for marketing managers in order to forecast to which buying cluster a farmer would belong, and in this way, use the appropriate marketing tools.

These results are different from those obtained by Alexander et al. (2005) for US farmers buying expendable inputs. Firstly, Argentine producers are, on average, younger than US farmers, a larger percentage have college studies and higher future growth expectations. Also, Argentine farmers tend to be more brand-loyal and have less price sensitivity than American producers. Regarding salespeople characteristics most valued, Argentine farmers value more 'technical competences' while American producers value 'honesty'.

Secondly, the US study finds five segments for expendable inputs while in this work we obtained four; and the importance of each segment is different. While for US farmers buying expendable inputs the Balance segment is the largest buyer, for Argentine producers buying seeds the

Performance group is the largest. The Performance farmer in Argentina would appear to be less price-sensitive and more loyal to brands than a US farmer in the same segment.

This work also differs from Alexander et al. (2005) in terms of the logit model results to predict farmers' membership to purchasing segments. While in Alexander's work the two variables providing the most predictive power are the producer college degree and the number of consultants hired by the producer, in this paper we have four significant variables with the most predictive power: sales volume, usage of emails as a relevant information source, brand similarity, and the salesperson who brings the best price.

Finally, this work provides two main contributions: the identification and characterization of four different segments for the seed markets in Argentina; and secondly, the existence of a segment membership forecast tool to predict in which segment an Argentine farmer would fit. Also from this paper we could raise the question of how input firms in Argentine segment their markets, and how this affects their marketing practices.

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Appendix 1. Seed Market in Argentina, Year 2009-2010

	Corn	Soybean	Wheat	Sunflower	Grain Sorghum	Other Seeds*	TOTAL
Planted land millions of ha	3.30	18.30	3.55	1.54	1.00		
Bags/hectares	1	2	2	1 bag 2.8 ha	1 bag 2 ha		
Price/Bag U\$ dollars	100	25	12.5	95U\$	70U\$		
Percentage Legal Seeds**	100%	20%	37%	100%	100%	100%	
Extended Royalties***		15%	15%				
Total Market	330 MM U\$	194 MM U\$	43 MM U\$	52 MM U\$	35 MM U\$	300 MM U\$	954 MM U\$

*Includes pastures and seed exports. No official figures for pastures. Based on industry estimates 100 million dollars.

Seed Exports: Based on ASA figures, 200 million dollars.

**For soybeans and wheat, there are self-fertilized plants, not all farmers buy the seeds, only a percentage of them do.

***Pays 2 U\$ per bag for soybeans and 1 U\$ in wheat and covers 15% of the market in both cases.

Appendix 2. Observable Characteristics. Demographics and Farm Features**Demographics and General Business Characteristics of Seed Segments**

<i>Demographics traits</i>	Segments				<i>Prob. of no association</i>
	<i>Performance</i>	<i>Price</i>	<i>Balance</i>	<i>Convenience</i>	
% College Graduate or more	50	46	39	56	0.155
Age <35	19	12	11	20	0.292
Age 35-44	34	35	31	32	0.292
Age 45-54	25	21	31	32	0.292
Age 55-64	15	22	20	8	0.292
Age >64	7	10	6	8	0.292
Age (Average years)	46	48	47	45	0.210

Notes. Single, double and triple asterisks (*) denote statistical significance at the 0.10, 0.05 and 0.01 level respectively. In percentage values per segment, except average age in years.

Farm Size, Sales, and Future Growth of Seed Segments

	Segments				<i>Prob. of no association</i>
	<i>Performance</i>	<i>Price</i>	<i>Balance</i>	<i>Convenience</i>	
Size 250-600 hectares	53	53	54	56	0.468
Size 600-1840 hectares	29	35	32	40	0.468
Size 1841 hectares or more	18	12	14	4	0.468
Total Sales < U\$S 200.000	20	23	14	4	0.074*
Total Sales U\$S 200.000-U\$S 500.000	39	33	39	60	0.074*
Total Sales > U\$S 500.000	41	44	46	36	0.074*
Future growth (% average)	31	41	23	52	0.554

Notes. Single, double and triple asterisks (*) denote statistical significance at the 0.10, 0.05 and 0.01 level respectively. In percentage values per segment, except average age in years.

