EXPERIENCE, LEARNING, AND INNOVATIVNESS IN BEEF PRODUCTION: RESULTS FROM A CLUSTER ANALYSIS

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Abstract

Research in agriculture and other industries has shown that innovativeness is a key driver of improved performance measures of small and medium-sized enterprises. The willingness to change current practice may be a function of the level of experience of the manager as well as the manager's commitment to learning. Firms with more experience may suffer from confirmation bias and therefore may not see the performance benefits that stem from innovative activities. Using data from a survey of beef producers, this study employs cluster analysis to segment firms along experience and learning variables. Using a non-hierarchical clustering procedure, three clusters emerge which represent younger firms with high and low levels of learning and older firms with moderate learning scores. The study employs one-way ANOVA tests to examine differences in innovativeness and performance across clusters. Results indicate firms with a commitment to learning have a greater willingness to accept innovations and are more satisfied with overall performance. The paper concludes with some implications for managers and policy makers.

Keywords: Cluster Analysis, experience, learning orientation, innovativeness, performance

1. Introduction

Many would consider prior experience to be an important resource for managers in any industry. One benefit of experience is that seasoned managers may be able to sense market changes more quickly or may be more adept at assessing the value of information (Martin, Staines 1994). Conversely, greater levels of experience may also lead to increased rigidity in accessing and applying new information (Kim, Oh, Swaminathan 2006). The USDA reports that the average age of a farmer has increased by one year in each agricultural census and younger operators tend to operate larger farms and earn greater returns (USDA -- National Agricultural Statistics Service 2007). It may be that as farmers' age, their aspirations change as well leading to different management decisions. This paper examines organizational learning within the context of primary agriculture to advance the understanding of the relationship between learning and experience.

Experience is often found to be an important resource that managers can draw upon (Wilson, Hadley, Asby 2001; Nuthall 2009). However, there may be instances where experience impedes innovation (and possibly performance) through structural rigidity (Boeker 1997; Koberg, Chesley, Heppard 2000). At the extreme, experience can inhibit learning if the manager makes incorrect inferences from the experience (Levinthal, March 1993). For example, as the tenure of the manager (and firm age) increases, confirmation bias may impede the search for additional perspectives on the competitive landscape (Klayman 1995). As lenders and policy makers often view experience as a value-enhancing resource, further analysis into the relationship between experience and learning may shed light on the issue within the context of production agriculture. One method that may help researchers and policy makers to increase their understanding of the issue is cluster analysis.

Cluster analysis is a statistical method that uses data of heterogeneous firms to create several homogeneous subgroups that are then analysed further. Previous studies have used cluster analysis

to group according to their use of meetings and extension (Rosenberg, Turvey 1991), their view of themselves as entrepreneurs (Vesala, Vesala 2010), extensiveness of livestock systems (Usai et al. 2006) and animal husbandry practices (Kiernan, Heinrichs 1994). Researchers in the management and marketing literatures have clustered firms by market orientation strategies (Greenley 1995; Gellynck et al. 2012), innovativeness (Hollenstein 2003) and knowledge management practices (Zack, McKeen, Singh 2009).

The goal of this study is to examine the relationship between a managerial experience and the commitment to learning using a cluster analysis. Specifically, this paper will use cluster analysis to examine if homogeneous subgroups based on managerial experience and the manager's commitment to learning exist. Secondly, this research will examine how these groups differ in terms of innovativeness and their satisfaction with performance.

2. Previous research on farm performance

Performance of agricultural firms is affected by both industry and firm-level factors. Studies have shown that innovative firms are able to achieve greater performance levels (Verhees, Meulenberg 2004; Capitanio, Coppola, Pascucci 2009). As the industry evolves and firms compete for inputs, employees, and land, how firms innovate and how they deploy strategic resources will become of greater interest to researchers and policy makers.

2.1. Experience and performance

Previous literature on decision making has shown that older managers tend to seek more information when making a decision and were more accurate in assessing the value of information (Taylor 1975). Martin and Staines (1994) find that many managers believe competence is a function of industry experience. The basis of these studies is that experience may improve decision-making and therefore may lead to greater managerial competence. However, as Argote and Miron-Spektor (2011) point out, there are cases where experience limits creative thinking through the continued use of heuristics that were successful in the past.

Within the agricultural context, Nuthall (2009) suggests there is a dearth of literature on the relationship between managerial experience and performance. Of the literature that does exist, most studies examine the relationship between experience and efficiency. For example, Wilson et al. (2001) find that managers with more experience, who actively seek information, and who manage large farms are able to achieve higher levels of technical efficiency. More recently, Hansson (2008) finds that managerial experience is significantly related to both short-term and long-term measures of efficiency.

2.2. Learning and performance

Within competitive environments, performance may depend on the learning ability of the firm. As the nature of competition changes, successful firms will be those that are quickly able to become aware of the changes and that can acquire the resources and capabilities needed to compete. To this end, Slater and Narver (1995) suggest that the learning orientation of the firm may be the only driver of sustained competitive advantage. In an agricultural context, Bone et al. (2003) found that managerial attitudes and continuing training were important factors in farm performance in a sample of Australian farmers. Furthermore, Napier and Nell (2007) find that successful farmers are using new technologies and innovation to remain successful in an increasingly

competitive environment. This is not possible without continuous learning on new technologies and markets. Finally, researchers have begun to use the balanced scorecard approach, which focuses on continuous learning, as a means to assess performance within agricultural systems (Lourenzani, Meirelles, Filho 2005; Shadbolt 2005)

3. Materials and methods

This research utilizes non-hierarchical cluster analysis using the two-stage clustering method within SPSS (version 20.0). Cluster analysis is a statistical tool that attempts to minimize the variation within groups while maximizing the variation between groups. This research then uses one-way ANOVA tests following the cluster analysis to assess if differences in scores of innovativeness and performance across groups are significant.

Data for this paper come from a questionnaire on managerial culture on beef farms in Illinois. The sampling frame (n = 1569) was based on a mailing list of members of the Illinois Beef Association in 2007. In total, respondents operating cow-calf herds and feeding out steers and heifers returned 347 usable questionnaires. This is study uses responses from 285 cow-calf producers in Illinois. Respondents in this sample are on slightly older than the average farmer is (68 years of age) and have managed their operations for an average of 32 years. The average farm consists of 942 acres and herd sizes average 69 animals.

The survey asked respondents to rate their level of agreement with questions that related to their level of innovativeness, performance, and the learning orientation of the firm. The survey also asked respondents how long they have been producing beef. The survey included five items from Sinkula, Baker, and Noordewier's (1997) organizational learning scale to measure commitment to learning. This scale examines the view that organizational learning is an investment that the firm can deploy to achieve certain advantages in the market. A scale developed by Hurley and Hult (1998) was included to measure firm innovativeness. The innovativeness scale asked farm managers to rate their level of agreement with different items that examined the penchant for managers to utilize innovative strategies to solve problems on the farm. Finally, performance was measured five subjective indicators. We use subjective performance as opposed to objective measures of performance as our sample consisted of small, privately held businesses that are generally unwilling to share confidential financial data, even in an anonymous setting.

Appendix A displays the survey items as well as reliability statistics.

4. Results

Table 1 displays the result of the cluster analysis. Using two-step clustering, three clusters emerge from the data. The distribution of firms across clusters is uniform as the ratio of largest cluster to smallest cluster is only 1.49 (113/76). Cluster 1 consists of firms that have more than 20 years of experience but score on the low end for learning orientation. Cluster 2 consists of firms with over 50 years' experience and a higher learning orientation than firms in Cluster 1. Cluster 3 consists of firms with the least experience (23 years) but the highest scores on the learning orientation scale.

As the input variable used in the clustering procedure was a summated scale, meaningful differences in scores are not apparent. Table 2 displays the individual items that make up the learning orientation scale and the differences across cluster groups. As one might expect, firms in Cluster 3 have the highest score on each item while firms in Cluster 1 have the lowest score.

Scores for firms in Cluster 2 are similar to the overall average score for the items. The largest differences between clusters occur in items assessing the shared vision of the firm and on items measuring the questioning of assumptions.

Following the cluster analysis, comparisons of innovativeness and performance scores were conducted using one-way ANOVA. Table 3 reports the results of this comparison. As one might expect given previous findings, firms that have a higher commitment to learning also have higher scores on organizational

Table 1. Average scores of experience and learning across clusters

	Cluster 1	Cluster 2	Cluster 3
Experience (years)	25.85	51.83	23.01
Learning Orientation	31.17	35.99	40.91
Herd Size	64.17	76.84	70.92
Acres Operated	908.87	1069.03	882.50
Operator Age	69.44	62.97	70.52
Education*	3.97	3.49	4.03
Number of cases	113	76	96

* 1 = some high school, 2 = high school grad, 3 = some college, 4 = vocational/tech degree, 5 = college grad, 6 = graduate degree

Table 2. Differences in learning orientation items across cluster groups

Learning Orientation Items	Cluster 1 E = 25.85 L = 31.17	Cluster 2 E = 51.83 L = 35.99	Cluster 3 E = 23.01 L = 40.91	Average	Difference (High-Low)
The basic values of this farm include learning as a key to improvement.	4.29	4.75	5.33	4.76	1.04
Our take is that learning is an investment, not an expense.	4.31	4.91	5.53	4.88	1.22
Learning on my farm is seen as a key commodity necessary to guarantee survival.	4.33	4.96	5.50	4.89	1.17
We are not afraid to challenge assumptions we have made about our customers.	3.76	4.21	5.01	4.30	1.25
There is total agreement on our organizational vision on our farm.	3.59	4.02	4.69	4.08	1.10
All employees are committed to the goals of this farm.	3.81	4.57	5.11	4.45	1.30
Employees view themselves as partners in charting the direction of the farm.	3.62	4.51	5.02	4.33	1.40
Personnel on this farm realize that the very way they perceive the market must be continually questioned and adapted.	3.46	4.07	4.71	4.04	1.25

Table 3. Innovativeness and performance scores across cluster groups

	Cluster 1 E = 25.85 L = 31.17	Cluster 2 E = 51.83 L = 35.99	Cluster 3 E = 23.01 L = 40.91	F-Statistic
Innovativeness (Summated)	22.07	23.47	25.57	29.779***
Technical innovation accepted	4.15	4.50	4.91	15.741***
Seldom seek innovative ideas#	4.31	4.51	5.10	14.183***
Innovation accepted	4.12	4.59	4.93	22.336***
Penalized for new ideas#	5.01	5.17	5.46	5.240*
Innovation is risky#	4.48	4.70	5.17	10.759**
Performance (Summated)	21.90	23.51	24.64	7.610**
Return on farm assets met expectations#	3.59	3.78	3.84	1.000
Satisfaction with overall performance	3.70	4.13	4.45	11.962**
Return on production investments	3.79	4.18	4.31	6.700*
Cash flow was satisfactory#	3.72	3.74	3.85	0.313
Return on marketing investments	3.80	4.05	4.26	5.361*
We receive higher prices than competitors	3.44	3.74	3.96	5.972*

Note: Items with an # were negatively phrased and were reverse coded, F-statistics: ***,**,* signify significance at the 0.001, 0.01, and 0.05 levels, respectively

innovativeness. Greatest differences between the clusters occur on items that measure the acceptance of innovation and the reverse coded item measuring how often they seek innovative ideas.

Satisfaction with performance did not differ as significantly across clusters. While the summated performance score was significantly different across clusters, differences among individual items were significant in four of the six items. The analysis shows no significant differences in satisfaction with return on farm assets or cash flow. Firms that had a commitment to learning were more satisfied with overall performance and the return on production and marketing investments. Firms with higher learning scores also were more likely to agree that they received higher prices than their competitors.

5. Discussion

The goal of this research was to examine the role of learning in innovativeness and performance. Using two-step cluster analysis, three clusters emerge using years of managerial experience and a summated learning orientation score as inputs. Cluster 1 consisted of firms with over 20 years' experience but lower learning orientation scores. Firms in Cluster 2 had extensive experience and somewhat higher learning orientation scores. Cluster 3 consisted of firms with the least amount of experience in the beef industry but the highest scores on the learning orientation items. Interestingly, a cluster of firms that had high experience and low learning did not emerge from the data. This may be due to survivor bias as firms that do not view learning as a key to survival or do not question assumptions may have already exited the industry.

One-way ANOVA analysis revealed that scores on innovativeness and performance items were significantly different across clusters. Firms that were more likely to agree with the items assessing learning orientation, that is, those with higher scores on learning orientation items also had higher scores for items that measured the level of innovativeness and performance. This result seems to corroborate the findings of Wilson et al. (2001) who find that farms with more experience also exhibit higher levels of technical efficiency. This increase in efficiency may be the result of the willingness these farms display in the adoption of new technologies.

Policy makers interested in helping small farmers succeed may find that programs such as demonstration farms (Pangborn, Woodford, Nuthall 2011) and learning groups such as the Beef Profit Partnerships model that has been successful in Australia and New Zealand (Clark et al. 2007) may increase the adoption of best practices and improve the viability of small and beginning farms. The formation of production alliances in South Africa have shown some promise as they are methods for managers of smaller farms to get together to overcome size inefficiencies and share valuable information (Terblanche, Willemse 2011).

The agricultural industry is continually evolving. Globalization and consolidation are leading to increased competition for inputs and market access. Firms that do not stay abreast of these changes may find themselves unable to compete with firms that have invested time and money in building a learning orientation. Future research could examine how firms with a learning orientation acquire relevant information. Historically, farm consultants have played an important role in the provision of market information and strategic planning to primary agriculture. More technologically adept farmers may find that supplementing that service with information from online social media platforms (i.e. Twitter, Facebook, LinkedIn, and YouTube) is also beneficial. Trough social media, producers can participate in discussions and chats where participants share their views and experiences on production and management issues. Through these online discussions with participants located all over the world, farmers receive an antidote for structural and cognitive rigidity, which may limit the innovativeness and performance of their farm.

This results presented here should be of interest to managers and policy makers. These findings seem to corroborate the results from recent research on factors affecting performance of SMEs outside of agriculture which found that firms that emphasize continual learning are more innovative and have better performance (Rhee, Park, Lee 2010; Real, Roldán, Leal 2012). These results may be especially important to small and beginning firms that may not the benefit of previous experience from which to draw on when issues arise. However, as seen by these results, beginning firms may only become experienced firms if they refrain from becoming too rigid continually question business and production practices and have a willingness to change.

6. References

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APPENDIX A. MEASURMENT ITEMS

Measurement items	Mean	Standard deviation	Item - to - total correlation
Learning Orientation (Alpha = 0.837)			
The basic values of this farm include learning as a key to improvement	4.76	0.891	0.556
Our take is that learning is an investment, not an expense.	4.88	0.968	0.570
Learning on my farm is seen as a key commodity necessary to guarantee survival	4.89	0.960	0.649
We are not afraid to challenge assumptions we have made about our customers	4.30	1.055	0.483
There is total agreement on our organizational vision on our farm	4.08	1.089	0.506
All employees are committed to the goals of this farm.	4.45	1.095	0.676
Employees view themselves as partners in charting the direction of the farm	4.33	1.190	0.581
Personnel on this farm realize that the very way they perceive the market must be continually questioned and adapted	4.04	1.040	0.529
Innovativeness (Alpha = 0.712)			
Technical innovation based on research results is readily accepted	4.50	1.020	0.477
We seldom seek innovative ideas which we can use on our cattle operation#	4.63	1.148	0.539
Innovation is readily accepted in our beef operation.	4.52	0.942	0.529
Individuals on our farm are penalized for new ideas that don't work#	5.20	1.020	0.297
Innovation in our farm is perceived as risky and is resisted#	4.77	1.118	0.520
Performance (Alpha = 0.819)			
The return on farm assets did not meet expectations last year#	3.73	1.328	0.656
We were very satisfied with the overall performance of the farm last year	4.07	1.153	0.710
The return on production investments met expectations last year.	4.07	1.092	0.756
The cash flow situation on the farm was not satisfactory#	3.77	1.312	0.559
The return on marketing investments met expectations last year.	4.02	1.041	0.624
The prices we receive for our product is higher than that of our competitors	3.69	1.101	0.249