Technology Systems and Business Performance on Wisconsin Dairy Farms[1]

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Introduction

This study investigates the impact of technology system adoption on Wisconsin dairy farm business performance. A previous study considered the impact individual technologies have on Wisconsin dairy farm business performance.[3] A potential shortcoming of that study is that technology tends to be adopted in tandem with other technology (free stall housing with pit parlor milking system) suggesting an interdependence or correlation relationship. The Pearson Correlation Coefficents are positive and significant for Total Mixed Ration (TMR), housing type, waste handling system, milking system and Bovine Somatatropin (BST) use.[4] This suggests that much of the technology adoption occurs as a system, not as independent, separate items.

Two technology systems were considered and compared. One system, referred to as "Recent" Technology, has the following characteristics: use TMR, use BST on at least 50% of the herd, use free stall housing, use either pit parlor or flat barn milking system and store manure for at least six months. The second system, referred to as "Mature" Technology, has these characteristics: don't use TMR or BST, use stanchion housing, a pipeline milking system and have little or no manure storage capacity. A TMR provides the feed to cows with greater physical efficiency and accuracy and BST is injected into cows to increase milk production. A pit parlor is a system of fixed milking units surrounding a pit within which the milker works and a flat barn is similar in design to a pit parlor but without the pit.

Data and Methodology

The Agriculture Financial Advisor (AgFA©)[5] data set was used for this study. AgFA is a sample of Wisconsin dairy farms from which financial and production data is collected annually. This study uses 2005 data composed of a sample of approximately 600 dairy farms. Of the approximately 600 farms in the AgFA data set, 35 met all the characteristics of the "Recent" Technology System and 89 met all the characteristics of the "Mature" Technology System.

Table 1 compares the herd size distribution of the AgFA sample with the population of Wisconsin dairy farms. The AgFA sample is over represented in the 50 cow and above herd sizes and under represented in the less than 50 cow herd sizes relative to the population. This creates a potential problem when inferring statistical results from the AgFA sample to the general population. Since technology tends to favor adoption by larger farms, the over representation of large dairy farms in the sample may bias results.

Table 1
2005 Wisconsin Dairy Farm Size Groups: Population vs. AgFA[6]

Size (head)	Population	AgFA
1-29	14.4%	1.8%
30-49	25.5%	15%
50-99	41.8%	48%
100-199	12.1%	20%
200-499	4.9%	10%
500+	1.3%	4.6%

Hypothesis Testing is the statistical procedure used in this study to identify business performance differences between "Recent" and "Mature" technology farms. The P-values presented in Table 2 are a component of the hypothesis testing process. The P-value provides an indication of the probability of a difference existing between two groups ("recent" and "mature" technology farms) with the smaller the P-value, the larger the chance of a difference. P-values of 10% or less usually indicate a difference, referred to as statistically significant, between two groups and will be the criteria of

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5 AgFA@ (Agriculture Financial Advisor) – http://cdp.wisc.edu. AgFA is an active/real time database for collecting and analyzing data. The number of records will likely increase throughout the years.

6 2006 Wisconsin Agricultural Statistics. Department of Agriculture, Trade and Consumer Protection, October 2006.

measure used in this study. The Hypothesis Testing procedure requires a Null Hypothesis for each attribute studied. A hypothesis is a statement about the value of the attribute for each of the two groups. In all cases the Null Hypothesis, given the symbol Ho, states that the arithmetic means of the two groups are NOT statistically different. In this study, rejecting the Null Hypothesis requires a P-value of 10% or less and suggests there is a business performance attribute difference between the "Recent" technology and "Mature" technology farms.

Results

The results in Table 2 present group means and P-values for five business performance measures selected because of their importance in the technology adoption process. Rate of Return on Assets (ROROA) is used as the profit measure. The impact on profit should be the most important deciding factor for the farmer-adaptor. Milk per Cow is used to capture the impact of technology adoption on physical production. Income per Cow is used to measure the impact of technology on revenue generation. Finally, two Total Cost measures are presented, one on a per cow basis and the other on a cwt of milk produced basis.

Table 2 indicates that dairy farms adopting technology have superior business performance. For instance, the mean ROROA for "Recent" technology farms is 10.065 %, for "Mature" technology farms it is 3.24% and the P-value is 0%. The 0% P-value indicates that the Null Hypothesis(Ho) is rejected and the difference in ROROA between "Recent" and "Mature" technology farms and the direction of difference is statistically significant which in this case means there is a high probability that all users of the set of technology identified as "Recent" technology have higher ROROA than users of the set of technology identified in this paper as "Mature" technology. Besides higher ROROA, the "recent" technology farms have statistically significant higher Milk per Cow and Income per Cow and lower Total Cost per Cwt. Total Cost per Cow is significantly higher for the "Recent" technology farms, likely due to technology acquisition costs and higher operating costs, such as feed, but the higher Income per Cow exceeds the higher Cost per Cow resulting in higher ROROA.

Table 2
Technology Systems and Business Performance

Attribute	Ho: "Recent" Technology = "Mature" Technology*		P-Value (%)
	Means		
	"Recent" Technology	**"Mature" Technology**	
ROROA (%)	10.06	3.24	0
Milk per Cow (lbs)	24,293	18,181	0
Income per Cow ($)	4,713	3,603	0
Total Cost per Cow ($)	4,100	3,337	0
Total Cost per Cwt ($)	16.98	18.66	1

* "Recent" Technology: used TMR, BST on at least 50% of the herd, free stall housing, either a pit parlor or a flat barn milking system and stored manure for at least six months.
"Mature" Technology: do not use TMR or BST, used stanchion housing, a pipeline milking system and had little or no manure storage capacity.

Conclusion

This study compared two groups of farms from the AgFA© data set. One group, referred to as "Recent" Technology, used TMR, BST on at least 50% of the herd, free stall housing, either a pit parlor or a flat barn milking system and stored manure for at least six months. The second group, referred to as "Mature" Technology, did not use TMR or BST, used stanchion housing, a pipeline milking system and had little or no manure storage capacity.

Technology, if useful to a business, should improve financial performance, especially profit. In a competitive industry like dairy farming where the individual farmer has no control over milk prices, the ability to create additional profit margin via other means is critically important. These results suggest that adoption of certain technology, specifically a system this study referred to as "Recent" Technology, has helped create that additional profit.

Appendix

Table A
Pearson Correlations for Technologies*

	TMR	Milking System	Housing Type	Waste Handling System	BST
TMR	1	.462	.306	.382	.327
Milking System	.462	1	.701	.444	.254
Housing Type	.306	.701	1	.419	.130
Waste Handling System	.382	.444	.419	1	.234
BST	.327	.254	.130	.234	1

* All correlations are significant at the 1% level.