Characterization of Kentucky dairy producer decision-making behavior

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ABSTRACT

To address dairy clientele needs, industry professionals need to understand how dairy producers make decisions. A survey was distributed to all licensed Kentucky milk producers ($n = 1,074$) to better understand factors that influence dairy producer decisions. A total of 236 surveys were returned; 7 were omitted because they were incomplete, leaving 229 for subsequent analyses (21% response rate). The survey consisted of questions about dairy operational success criteria, decision evaluation criteria, information sources, and technology adoption. The mean response to each survey question was calculated after assigning the following numeric values to producer response categories: 1 = not important, 3 = important, 5 = very important. The most important source of influence or information in decision making was advice from consultants, nutritionists, and veterinarians (3.70 ± 1.23), followed by consultation with business partners and family members (3.68 ± 1.29), and intuition and gut feeling (3.10 ± 1.45). Producers with large herds (≥ 200 cows) relied more heavily on information from consultants, nutritionists, and veterinarians and on employee input than did producers with small herds (1 to 49 cows). Producers with small herds did not use effect on employee morale as a criterion to evaluate decisions as much as those with larger herds did. In regard to adoption of automated monitoring technologies, producers indicated that modest adoption rates were a result of (1) not being familiar with technologies that are available (55%), (2) undesirable cost to benefit ratios (42%), and (3) too much information provided without knowing what to do with it (36%). As herd size increased, the percentage of producers selecting poor technical support and training and compatibility issues as reasons for slow adoption of automated technologies increased. This insight into dairy producer decision making should help industry professionals address dairy producer issues and concerns.

Key words: dairy extension, survey, decision making

INTRODUCTION

Dairy farm sustainability is a direct result of dairy producer decision-making processes. Understanding how dairy producers make decisions is important to extension and industry professionals as they strive to increase adoption of best management practices. Performance of the dairy herd is directly related to management practices employed (Carley and Fletcher, 1986). To increase productivity, producers have adopted new management technologies and techniques (King and Rollins, 1999). Some of these changes include an increased adoption of computer monitoring technologies and an increase in using Internet resources. Although technology use has increased, adoption rates in the dairy industry have been slow compared with other industries. Dairy producers may not use the Internet as extensively as other business managers. Maurer and Fast (2007) determined that only 56% of surveyed Kentucky dairy producers had Internet access in their homes, and 62% of producers indicated that the Internet was not an effective information delivery method. Slow adoption of new technologies is not limited to computers and the Internet; automated monitoring systems have been adopted slowly in the dairy industry despite widespread availability (Huirne et al., 1997; Gelb et al., 2001). Using computerized record systems and automated monitoring systems improve on-farm management and decision making (Spahr, 1993). Despite widespread availability, adoption of these technologies in the dairy industry has been relatively sparse to date (Huirne et al., 1997; Gelb et al., 2001).

Extension professionals dedicate considerable time toward development of targeted local, regional, and state meetings to address dairy producer educational needs (Chase et al., 2006). Dairy extension programming efforts must continually evolve to meet the needs of a changing clientele base (Hutjens et al., 2004). Knowing dairy producers' management practices and decision-making behavior is important for extension educators who develop educational programs (Zimmerman et al., 2006). Understanding dairy producers' management practices helps extension professionals understand how producers make decisions. This, in turn, helps extension professionals design producer-oriented programs.

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To evaluate decision-making processes, a survey was designed to ask Kentucky dairy producers directly about how they make decisions. The objectives of this survey were to (1) evaluate decision-making processes, (2) determine the cause of slow technology adoption, (3) determine sources of information for making decisions, (4) assess how producers measure success, and (5) determine criteria used for evaluating decisions.

MATERIALS AND METHODS

A 5-page survey was distributed to all licensed milk producers in Kentucky ($n = 1,074$). Surveys were mailed on July 1, 2008. To maintain producer anonymity, each survey was labeled with a number that corresponded to a name and address. The list of producers' names and addresses was only used to determine who to send follow-up surveys to and was not referred to after final survey distribution. Two weeks after the first mailing, a follow-up postcard was mailed to remind producers to return the survey. On August 1, 2008, the survey was resent to producers who had not returned the initial survey. A total of 236 surveys were returned; 7 were omitted because they were incomplete, leaving 229 for subsequent analyses (21% response rate). The survey consisted of questions about dairy operational success criteria, decision evaluation criteria, information sources, and technology adoption. For some questions, producers were asked to select a number on a 1 to 5 Likert (1932) scale, with 1 indicating "not important" and 5 indicating "very important."

Data were entered into an online survey tool (Key-Survey, Braintree, MA). Statistical analyses were conducted using SAS software (SAS Institute Inc., Cary, NC). Surveys were categorized by herd size, production system, region within the state, operator age, and production level. Herds were categorized by herd size to reflect management similarities as follows: 1 to 49, 50 to 99, 100 to 149, 150 to 199, and 200 to 1,200 cows. Producers were asked to categorize their dairy production system by selecting the option that best described their situation: pasture grazing, partial confinement, or total confinement. Regions within the state were categorized as East, South Central, North Central, West, and Far West. Operator age categories were defined as follows: <35, 35 to 44, 45 to 54, 55 to 64, and ≥ 65 yr of age. Herds were categorized into terciles based on reported milk production levels as follows: low (<22.7 kg/cow per day), mid (22.7 to 26.4 kg), and high (≥ 26.4 kg). Least squares means among categories were calculated for quantitative variables using the GLM procedure of SAS. Tukey's test for multiple comparisons was used and statistical differences were considered significant using a 0.05 significance level. For qualitative variables,

χ^2 analyses were conducted using the FREQ procedure of SAS. Statistical differences were considered significant at a 0.05 significance level.

RESULTS AND DISCUSSION

Operational Success Criteria

Descriptive statistics of surveyed herds and extension programming assessment were presented in Russell and Bewley (2011). When producers were asked to determine how they measured their operation's success, the most frequent response was ability to pay operating expenses without incurring unnecessary debt (92%), followed by well-being of animals in the herd (83%), producing superior quality milk (76%), keeping a balance in the checking account (73%), quality of life (67%), production per cow (58%), return on assets or return on equity (52%), net farm income per cow (50%), time off and time with family (44%), minimizing tax obligations (40%), reputation among other dairy producers (18%), and performance compared with other dairy producers (16%). Many of the criteria used by producers to evaluate their success were financial measures, including ability to pay expenses, keeping a balance in the checkbook, return on assets, net farm income, and minimizing tax obligations. However, from these results, it is clear that human factors are also quite important. Many producers indicated that quality of life, time off, time with family, and reputation among other dairy producers were criteria they used to evaluate their success. In an era where dairy producers are under increased scrutiny for how they care for their animals, perhaps the most interesting result from this question was that 83% of producers indicated that well-being of the animals in the herd was one of the ways they measure their success. Milk quality and production per cow were also listed as criteria for success evaluation.

When categorized by herd size (Table 1), producers with ≥ 200 cows were more likely ($P < 0.05$) to choose minimizing tax obligations as a form of dairy operational success criteria than producers with <200 cows. As herd size increased, the number of managers choosing production per cow as a way to evaluate dairy operational success increased. These results may demonstrate an increased focus on business and production among larger herds. No differences among herd size categories were observed for the following success criteria: ability to pay operating expenses without incurring unnecessary debt, keeping a balance in the checkbook, net farm income per cow, performance compared with other dairy producers, producing superior quality milk, quality of life, reputation among other dairy producers,

Table 1. Criteria used to measure dairy operational success among herd size categories as indicated by dairy operations responding to the Kentucky dairy extension survey¹

Criterion	Herd size					χ^2
	1 to 49 (n = 80)	50 to 99 (n = 84)	100 to 149 (n = 25)	150 to 199 (n = 12)	≥200 (n = 12)	
Ability to pay operating expenses without incurring unnecessary debt	91	89	92	92	100	0.84
Keeping a balance in the checking account	76	77	67	58	64	0.48
Minimizing tax obligations	30	46	42	33	73	0.04
Net farm income per cow	48	48	58	33	82	0.14
Performance compared with other dairy producers	14	13	17	0	36	0.16
Producing superior quality milk	78	68	79	67	100	0.15
Production per cow	53	55	63	67	82	0.36
Quality of life	65	68	75	42	73	0.35
Reputation among other dairy producers	16	15	17	0	36	0.22
Return on assets or return on equity	44	57	50	33	73	0.16
Time off and time with family	36	50	46	25	45	0.30
Well-being of animals in the herd	88	76	79	75	91	0.34

¹Percentage of producers indicating that a criterion is used.

return on assets and return on equity, time off or time with family, or well-being of animals in the herd.

Decision-Making Criteria

Criteria most chosen by producers to evaluate decisions were ability to generate cash flow (95%), followed by availability of funds to pay for investments (81%) and effect on the business's long-term financial performance (71%), effect on the business's short-term financial performance (55%), government regulations (43%), time needed to implement decision (42%), prestige, pride, or reputation associated with the outcome (27%), effect on employee morale (22%), anticipated reaction from consumers (16%), what your neighbor is doing (7%), and desire to be the first to use a new practice (3%). In contrast to overall operational success, producers placed less emphasis on noneconomic factors for making individual decisions. Prestige, pride, or reputation (27%), effect on employee morale (22%), anticipated reaction from consumers (16%), what the neighbor is doing (7%), and desire to be the first to use a new practices were listed less frequently than economic criteria. This difference likely reflects that, although dairy producers evaluate their whole operation success on both business and human factors, individual decisions are influenced more by economic factors. This difference in philosophies could explain the struggles that many producers have in attaining financial and personal success.

As herd size increased, the percentage of producers considering the effect of a decision on the business's short-term financial performance increased ($P = 0.01$; Table 2). Producers with 150 to 199 cows were more likely ($P < 0.05$) to use time needed to implement a decision as a criterion compared with producers with

200 to 1,200 cows. As herd size increased, the percentage of producers who considered the effect of a decision on employee morale increased ($P < 0.01$). This is a logical result because larger herds generally have more employees. No differences among herd size categories were observed for the following decision criteria: ability to generate cash flow, anticipated reaction from consumers, availability of funds to pay for investments, desire to be the first to use a new practice, government regulations, prestige associated with decision outcome, or neighbor activities. When categorized by age (Table 3), producers ≥65 yr were more likely ($P < 0.05$) to use government regulations as a criterion than producers <35 yr. Producers <35 yr were less likely ($P < 0.05$) to use prestige, pride, or reputation associated with the outcome as a criterion compared with producers ≥65 yr.

Information Sources

Having reliable sources of information is important for producers when making decisions. Producers were asked about the importance of sources of information. Producers indicated advice from consultants, nutritionists, and veterinarians was the most important source of information, with a mean response of 3.70 ± 1.23 , followed by consultation with business partners and family members (3.68 ± 1.29), intuition and gut feeling (3.10 ± 1.45), advice from cooperative extension (3.05 ± 1.25), and printed magazines and publications (3.05 ± 1.21) (Table 4). Maurer and Fast (2007) indicated that producers relied heavily upon dairy magazines and newspapers, other dairy producers, and cooperative extension services, whereas Wilson et al. (1988) indicated that producers ranked communication with hired labor above the use of consultants. King and Rollins (1999)

Table 2. Criteria used to evaluate decisions among herd size categories as indicated by dairy operations responding to the Kentucky dairy extension survey¹

Criterion	Herd size					χ^2
	1 to 49 (n = 80)	50 to 99 (n = 84)	100 to 149 (n = 25)	150 to 199 (n = 12)	≥200 (n = 12)	
Ability to generate cash flow	94	95	92	100	100	0.76
Anticipated reaction from consumers	18	12	16	8	9	0.78
Availability of funds to pay for investments	78	80	80	92	91	0.74
Desire to be the first to use a new practice	3	0	8	0	0	0.13
Government regulations	41	43	32	50	64	0.47
Effect on the business's long-term financial performance	62	71	88	83	82	0.09
Effect on the business's short-term financial performance	42	55	60	83	82	0.01
Effect on employee morale	6	19	36	42	64	<0.01
Prestige, pride, or reputation associated with the outcome	23	30	36	33	27	0.70
Time needed to implement decision	30	51	44	58	27	0.06
What your neighbor is doing	10	5	0	8	0	0.30

¹Percentage of producers indicating influence of each criterion.

indicated that producers chose university specialists as the most trustworthy sources of information. When categorized by herd size (Table 5), producers with 1 to 49 cows were significantly less likely ($P < 0.05$) to use advice from consultants, nutritionists, and veterinarians as a source of information for decision making than producers with 200 to 1,200 cows. Producers with 200 to 1,200 cows were significantly more likely ($P < 0.05$) to use employee input as an information source than producers with 1 to 49 cows. This is rational, because larger farms tend to have more employees. Sources of information were also categorized by production system (Table 6). Producers with a total confinement system were significantly more likely ($P < 0.05$) to use advice from consultants, nutritionists, and veterinarians as a source of information than producers with pasture-grazing or partial confinement systems. Total confinement systems tend to be larger farms, which also indicated a greater importance of information from consultants,

nutritionists, and veterinarians. Producers with partial confinement systems were significantly more likely ($P < 0.05$) to use consultation with neighboring farmers as an information source than producers with a total confinement system. Producers with a pasture-grazing system were significantly less likely ($P < 0.05$) to use informal calculations to examine financial impact (e.g., paper, spreadsheets) than producers with a total confinement system.

Technology Adoption

Adoption of new technologies among dairy producers has been slow to date (Huirne et al., 1997; Gelb et al., 2001). Farm profitability can be increased through farm modernization that focuses on increased milk production and employee efficiency (Bewley et al., 2001). Improving efficiency of production has provided an important opportunity for dairy farmers in the United

Table 3. Criteria used to evaluate decisions among age (of primary operator) categories as indicated by dairy operations responding to the Kentucky dairy extension survey¹

Criterion	Age of primary operator (yr)					χ^2
	<35 (n = 28)	35 to 44 (n = 32)	45 to 54 (n = 58)	55 to 64 (n = 64)	≥65 (n = 26)	
Ability to generate cash flow	96	94	98	97	88	0.29
Anticipated reaction from consumers	19	16	18	11	8	0.67
Availability of funds to pay for investments	81	75	82	86	72	0.53
Desire to be the first to use a new practice	4	0	4	2	0	0.67
Government regulations	22	31	49	47	56	0.05
Effect on the business's long-term financial performance	74	75	81	64	68	0.33
Effect on the business's short-term financial performance	44	53	63	53	56	0.58
Effect on employee morale	11	25	23	19	24	0.67
Prestige, pride, or reputation associated with the outcome	22	25	32	20	52	0.04
Time needed to implement decision	33	25	51	47	32	0.09
What your neighbor is doing	4	16	4	3	12	0.08

¹Percentage of producers indicating influence of each criterion.

Table 4. Importance of sources of information or influence in dairy management decisions as indicated by dairy operations responding to the Kentucky dairy extension survey¹

Source	Response (% of total)				Total responses (no.)	Mean response (±SD)
	Not important	Important	Very important			
Advice from consultants, nutritionists, or veterinarians	7.59	50.00	42.41		224	3.70 ± 1.23
Consultation with business partners or family members	9.55	46.82	43.64		220	3.68 ± 1.29
Intuition or gut feeling	23.58	47.64	28.77		212	3.10 ± 1.45
Advice from UK cooperative extension	16.82	63.64	19.55		220	3.05 ± 1.25
Printed magazines or publications	18.10	61.09	20.81		221	3.05 ± 1.21
Consultation with neighboring farmers	21.82	54.55	23.64		220	3.04 ± 1.35
End of the year efforts to avoid paying taxes	33.18	43.60	23.22		211	2.80 ± 1.49
Informal calculations to examine financial impact (e.g., paper, spreadsheets)	33.01	49.28	17.70		209	2.69 ± 1.39
Employee input	38.28	49.28	12.44		209	2.48 ± 1.33
Formal decision-making techniques (e.g., investment analysis, decision trees)	49.76	43.06	7.18		209	2.15 ± 1.25
Conferences and trade shows	53.24	40.74	6.02		216	2.06 ± 1.22
Internet resources	58.13	35.96	5.91		203	1.96 ± 1.22

¹Mean response was calculated after assigning the following numeric values to producer response categories: 1 = not important; 3 = important; and 5 = very important.

Table 5. Importance of sources of information or influence in dairy management decisions among herd size categories as indicated by dairy operations responding to the Kentucky Dairy Extension survey¹

Source	Herd size				
	1 to 49 (n = 80)	50 to 99 (n = 84)	100 to 149 (n = 25)	150 to 199 (n = 12)	≥200 (n = 12)
Advice from consultants, nutritionists, or veterinarians	3.42 ± 0.14 ^b	3.70 ± 0.13 ^{ab}	3.72 ± 0.24 ^{ab}	4.17 ± 0.35 ^{ab}	4.50 ± 0.35 ^a
Advice from UK Cooperative Extension Service	2.97 ± 0.15	3.00 ± 0.14	3.16 ± 0.25	2.83 ± 0.37	3.50 ± 0.37
Conferences and trade shows	2.07 ± 0.14	1.91 ± 0.13	2.00 ± 0.25	1.83 ± 0.35	2.60 ± 0.38
Consultation with business partners or family members	3.53 ± 0.15	3.51 ± 0.14	4.08 ± 0.26	3.67 ± 0.37	4.60 ± 0.41
Consultation with neighboring farmers	3.21 ± 0.15	2.88 ± 0.15	2.67 ± 0.28	3.17 ± 0.39	3.20 ± 0.43
Employee input	2.01 ± 0.15 ^b	2.44 ± 0.14 ^{ab}	2.91 ± 0.27 ^a	2.67 ± 0.37 ^{ab}	3.40 ± 0.40 ^a
End of the year efforts to avoid paying taxes	2.58 ± 0.18	2.90 ± 0.17	2.83 ± 0.31	3.00 ± 0.43	3.36 ± 0.45
Formal decision-making techniques (e.g., investment analysis, decision trees)	2.00 ± 0.15	2.09 ± 0.14	2.30 ± 0.26	2.50 ± 0.36	2.80 ± 0.39
Informal calculations to examine financial impact (e.g., paper, spreadsheets)	2.46 ± 0.16	2.59 ± 0.15	3.09 ± 0.28	2.67 ± 0.39	3.20 ± 0.43
Internet resources	1.83 ± 0.14	1.87 ± 0.14	2.10 ± 0.27	2.00 ± 0.34	2.60 ± 0.38
Intuition or gut feeling	3.00 ± 0.17	3.00 ± 0.16	3.36 ± 0.31	3.17 ± 0.42	3.60 ± 0.46
Printed magazines or publications	3.23 ± 0.14	2.98 ± 0.13	3.00 ± 0.25	2.33 ± 0.35	3.00 ± 0.36

^{a,b}Least squares means within rows with different superscripts differ ($P < 0.05$).

¹Mean response was calculated after assigning the following numeric values to producer response categories: 1 = not important; 3 = important; and 5 = very important.

Table 6. Importance of sources of information or influence in dairy management decisions among production systems as indicated by dairy operations responding to the Kentucky Dairy Extension survey¹

Source	Pasture-grazing (n = 98)	Partial confinement (n = 77)	Total confinement (n = 29)
Advice from consultants, nutritionists, or veterinarians	3.40 ± 0.12 ^b	3.75 ± 0.14 ^b	4.38 ± 0.22 ^a
Advice from UK Cooperative Extension Service	3.08 ± 0.13	3.00 ± 0.15	2.93 ± 0.24
Conferences and trade shows	2.08 ± 0.12	1.88 ± 0.14	2.14 ± 0.23
Consultation with business partners/family members	3.51 ± 0.14	3.69 ± 0.15	3.97 ± 0.24
Consultation with neighboring farmers	2.92 ± 0.14 ^{ab}	3.24 ± 0.15 ^a	3.41 ± 0.26 ^b
Employee input	2.30 ± 0.14	2.39 ± 0.16	2.86 ± 0.25
End of the year efforts to avoid paying taxes	2.74 ± 0.16	2.89 ± 0.18	2.79 ± 0.28
Formal decision-making techniques (e.g., investment analysis, decision trees)	2.10 ± 0.13	2.04 ± 0.15	2.43 ± 0.23
Informal calculations to examine financial impact (e.g., paper, spreadsheets)	2.40 ± 0.14 ^b	2.71 ± 0.16 ^{ab}	3.14 ± 0.26 ^a
Internet resources	2.04 ± 0.12	1.63 ± 0.15	2.19 ± 0.23
Intuition or gut feeling	3.22 ± 0.15	2.94 ± 0.17	3.07 ± 0.27
Printed magazines or publications	3.17 ± 0.12	3.08 ± 0.14	2.64 ± 0.22

^{a,b}Least squares means within rows with different superscripts differ ($P < 0.05$).

¹Mean response was calculated after assigning the following numeric values to producer response categories: 1 = not important; 3 = important; and 5 = very important.

States to achieve an economic advantage (Kellogg et al., 2001). Often, producers may underestimate the value of these technologies because the costs of disease and reduced reproductive performance are not as easy to understand as simply looking at increases in milk production. New technologies give dairy producers the chance to measure physiological, behavioral, and production indicators on individual animals to help improve management strategies. These new technology systems could be critical in helping dairy producers achieve maximum efficiency of production if they were utilized. Knowing the reasons behind slow adoption rates could help extension professionals provide knowledge that is more accurate to dairy producers.

Producers with large dairies (200 to 1,200 cows) are more likely to adopt new technologies than producers with small dairies (<200 cows; Jackson-Smith and Barham, 2000). In our study, producers were asked about potential causes for slow adoption in a “check all that apply” question. Not familiar with new technologies was chosen by the most producers (55%, $n = 101$), followed by undesirable cost to benefit ratio (42%, $n = 77$), and too much information provided without knowing what to do with it (36%, $n = 66$; Table 7). When categorized by herd size (Table 8), producers with 200 to 1,200 cows were more likely ($P < 0.05$) to choose not enough time to spend on technology, poor technical support and training, and compatibility issues as concerns for adopting new technology than producers with 1 to 49 cows. No differences among herd size were observed for the following adoption concerns: too much information provided without knowing what to do with it, not reliable or flexible enough, poor integration with other farm systems and software, undesirable cost to benefit ratio, not familiar with technologies that are available,

better alternatives or easier to accomplish manually, too difficult or complex to use, not useful or does not address a real need, fear of technology or computer illiteracy, failure in fitting with farmer patterns of work, immature technology or waiting for improvements, lack of standardization, or lack of perceived economic value. Perceived economic returns from investing in a new technology are always a factor influencing technology adoption.

Additional factors affecting technology adoption include degree of impact on resources used in the production process, level of management needed to implement the technology, risk associated with the technology, institutional constraints, producer goals and motivations, and having an interest in a specific technology (Dijkhuizen et al., 1997; van Asseldonk, 1999). Characteristics of the primary decision maker that influence technology adoption include age, level of formal education, learning style, goals, farm size, business complexity, increased tenancy, perceptions of risk, type of production, ownership of a nonfarm business, innovativeness in production, average expenditure on information, and use of the technology by peers and other family members. Producers will only adopt these new technologies if the benefits are clear and the technology is user-friendly (Spahr, 1993). How technologies fit within farmer patterns of work is an important consideration for technology adoption and implementation. Technology manufacturers may focus on the technical aspects of technologies while overlooking important sociological considerations. Simply purchasing a technology does not provide the dairy producer with a return on investment. Rather, successful implementation of the technology involves good technical support and continuous training. The producer concerns listed here

Table 7. Factors influencing slow adoption rates of automated monitoring technologies as indicated by dairy operations responding to the Kentucky dairy extension survey

Factor	Producers indicating influence	
	No.	(%)
Not familiar with technologies that are available	101	55
Undesirable cost to benefit ratio	77	42
Too much information provided without knowing what to do with it	66	36
Not enough time to spend on technology	56	31
Lack of perceived economic value	55	30
Too difficult or complex to use	53	29
Poor technical support or training	52	28
Better alternatives or easier to accomplish manually	43	23
Failure in fitting with farmer patterns of work	40	22
Fear of technology and computer illiteracy	39	21
Not reliable or flexible enough	33	18
Not useful or does not address a real need	27	15
Immature technology or waiting for improvements	18	10
Lack of standardization	17	9
Poor integration with other farm systems and software	12	7
Compatibility issues	12	7

should serve as valuable information for dairy advisors and technology manufacturers in assisting with technology implementation. Clearly, dairy producers consider economic returns as important selection criteria. The reasons listed here also demonstrate the importance of technologies filling real management voids. Technologies should be provided with adequate technical support together with information in a user-friendly format.

CONCLUSIONS

This study provides dairy industry professionals information about the decision-making processes of dairy

producers. Professionals can use this information to guide dairy producers to incorporate best management practices. Understanding how dairy producers make decisions helps us understand the difference between what is technically achievable versus what is actually achieved. Most dairy producers understand how to implement best management practices. However, people factors often impede progress. The results of this survey demonstrate that many noneconomic factors influence dairy producer decisions. At times, dairy producers may make decisions that are less than ideal from an economic perspective. However, they may be the best decision for the operation, as every operation

Table 8. Factors influencing slow adoption rates of automated monitoring technologies by herd size¹

Factor	Herd size					χ^2
	1 to 49 (n = 80)	50 to 99 (n = 84)	100 to 149 (n = 25)	150 to 199 (n = 12)	≥ 200 (n = 12)	
Too much information provided without knowing what to do with it	31	32	62	33	44	0.11
Not reliable or flexible enough	13	20	33	17	11	0.32
Poor technical support or training	18	26	52	33	67	0.01
Poor integration with other farm systems and software	8	5	10	0	0	0.63
Undesirable cost to benefit ratio	34	41	43	67	56	0.27
Not familiar with technologies that are available	54	61	52	58	22	0.30
Better alternatives or easier to accomplish manually	20	24	38	8	22	0.33
Too difficult or complex to use	18	30	38	42	22	0.24
Compatibility issues	2	5	14	0	22	0.03
Not enough time to spend on technology	18	39	24	33	56	0.04
Not useful or does not address a real need	16	15	10	8	11	0.90
Fear of technology or computer illiteracy	15	27	14	25	22	0.44
Failure in fitting with farmer patterns of work	20	20	19	25	33	0.89
Immature technology or waiting for improvements	5	11	19	0	22	0.15
Lack of standardization	10	6	10	0	33	0.07
Lack of perceived economic value	30	32	19	8	56	0.14

¹Percentage of producers indicating influence of each factor.

makes decisions with multiple attributes. Much of this may be reflective of a “way of life” approach to dairy farming. Professionals should focus on the slow adoption of technology by providing dairy producers with accurate information about the technologies. Extension educators can use this information to help guide dairy producers’ decisions. Our results suggest that dairy producers may not be as ready for the transition to electronic education as university administrators would like. Traditional programs and printed materials are still effective methods for reaching clientele.

REFERENCES

- Bewley, J., R. Palmer, and D. Jackson-Smith. 2001. Modeling milk production and labor efficiency in modernized Wisconsin dairy herds. *J. Dairy Sci.* 84:705–716.
- Carley, D. H., and S. M. Fletcher. 1986. An evaluation of management practices used by Southern dairy farmers. *J. Dairy Sci.* 69:2458–2464.
- Chase, L. E., L. O. Ely, and M. F. Hutjens. 2006. Major advances in extension education programs in dairy production. *J. Dairy Sci.* 89:1147–1154.
- Dijkhuizen, A. A., R. B. M. Huirne, S. B. Harsh, and R. W. Gardner. 1997. Economics of robot application. *Comput. Electron. Agric.* 17:111–121.
- Gelb, E., C. Parker, P. Wagner, and K. Roskopf. 2001. Why is the ICT adoption rate by farmers still so slow? Pages 40–48 in *Proc. ICAST*, Vol. VI. International Conference on Agricultural Science and Technology (ICAST), Beijing, China.
- Huirne, R. B. M., S. B. Harsh, and A. A. Dijkhuizen. 1997. Critical success factors and information needs on dairy farms: The farmer’s opinion. *Livest. Prod. Sci.* 48:229–238.
- Hutjens, M. F., T. P. Lyons, and K. A. Jacques. 2004. Meeting the educational needs of dairy clientele in 2020. Pages 205–210 in *Proc. Nutritional Biotechnology in the Feed and Food Industries; Proc. 20th Alltech Symp.* Nottingham University Press, Nottingham, UK.
- Jackson-Smith, D. B., and B. Barham. 2000. The changing face of Wisconsin dairy farms: A summary of PATS’ research on structural change in the 1990s. Vol. 7. Program on Agricultural Technology Studies, College of Agricultural and Life Sciences, University of Wisconsin–Madison.
- Kellogg, D. W., J. A. Pennington, Z. B. Johnson, and R. Panivivat. 2001. Survey of management practices used for the highest producing DHI herds in the United States. *J. Dairy Sci.* 84(E. Suppl.):E120–E127.
- King, R. N., and T. J. Rollins. 1999. An evaluation of an agricultural innovation: Justification of participatory assistance. *J. Extension* 37:4RIB2. Accessed Dec. 30, 2012. <http://www.joe.org/joe/1999august/rb2.php>.
- Likert, R. 1932. A technique for the measurement of attitudes. *Arch. Psychol.* 140:1–55.
- Maurer, R. C., and J. A. Fast. 2007. Kentucky dairy producers survey results. Accessed Dec. 30, 2012. http://www.rs.uky.edu/regulatory/milk/survey/E_Dairy_Producer_Comprehensive_Final_Report.pdf.
- Russell, R. A., and J. M. Bewley. 2011. Producer assessment of dairy extension programming in Kentucky. *J. Dairy Sci.* 94:2637–2647.
- Spahr, S. L. 1993. New technologies and decision making in high producing herds. *J. Dairy Sci.* 76:3269–3277.
- van Asseldonk, M. A. P. M. 1999. Economic evaluation of information technology applications on dairy farms. PhD Thesis. Wageningen Agricultural University, Wageningen, the Netherlands.
- Wilson, P. N., T. R. Luginsland, and D. V. Armstrong. 1988. Risk perceptions and management responses of Arizona dairy producers. *J. Dairy Sci.* 71:545–551.
- Zimmerman, E. K., L. A. Holden, J. E. Park, and J. Hyde. (2006). Relationship of dairy producer management styles to overall return on assets. *J. Extension* 44:6RIB6. Accessed Dec. 30, 2012. <http://www.joe.org/joe/2006december/rb6p.shtml>.