

Individualism or Cooperation: Preferences for Sharing Machinery and Labor,

Curtis Stofferahn

Curtis Stofferahn is Associate Professor, Department of Sociology, at the University of North Dakota.

As a result of problems associated with high machinery costs, farmers in the United States are examining group-farming arrangements that permit them to share machinery and labor. While group-farming arrangements are more frequent elsewhere, they are infrequent in the United States. The purpose of this research was to determine which social, cultural, economic, and farm structural characteristics influence farmers to support sharing machinery or labor. The results of the one-way analysis of variance indicated that those who rent more land, have more education, are slightly older, and are more involved in cooperatives would be more willing to share machinery or labor. In a discriminant analysis, only education and cooperative involvement had any power to classify farmers into those willing and not willing to share machinery and labor. Finally, in a logistic regression procedure, only acres rented, education, and cooperative involvement significantly predicted willingness to share labor or machinery.

The high costs of machinery are making entrance into farming increasingly difficult. It is also making it difficult for existing farmers to remain economically viable, to replace machinery,

or to adopt new technologies. As a result of these problems, farmers in the United States are examining alternative farming arrangements that permit them to share machinery and capital investment in machinery (see McGill 2000, 10–13; Wehrspann 1999, 40–42; Tonneson 1997, 8–12; Smith 1998, 14–15). In the United States, a few examples of these alternative farming arrangements exist, but no research on them has been conducted.

Farm machinery co-ops are organized by farmers who wish to share machinery and equipment. By pooling their money, they buy machinery and share fixed costs and operating expenses. The co-op owns the machinery on behalf of the members, each of whom has one vote in the operation of the co-op regardless of how much capital they have invested. These kinds of enterprises fit into the fourth type of collective farming defined by Galeski (1975, 17-43). He classifies collective farming into (1) those created by believers in an ideology, (2) those created by landless families who were able to acquire the land but not to start individual farms, (3) those organized by governments in order to reach national economic and social goals, and (4) those organized by farmers in gain the advantages of larger operations. Enterprises of the fourth type are very different from the other three types: they exist within competitive markets; they have to reduce costs of production in order to realize profits; and, for some indivisible technologies, they reduce their costs by spreading them over larger acreages. Therefore, farmers pool their resources of capital, land, and labor in order to produce more cheaply and to gain higher profits on the market.

Typical farm machinery cooperatives can be grouped into several categories (Harris 1999, and Harris and Fulton 1999b). The first two categories involve pooling whole sets of farm machinery and include those in which (1) machinery and income is pooled among all members of the co-op, and (2) those in which machinery is pooled among all members of the co-op, but

income is not pooled. The other kind of farm machinery cooperative does not involve the sharing of a whole set of machinery, but is structured to allow the sharing of individual machines among sub-sets of the cooperative members. This sharing is facilitated through the use of activity branches and member contracts.

The sharing of farm machinery through the formation of a farm machinery cooperative can provide farmers with a number of benefits (Harris and Fulton 1999b), including:

1. lower costs (the costs of owning and operating cooperatively are estimated to be 35 percent lower than the costs associated with individual ownership),
2. greater efficiency (by purchasing machinery as a group, members achieve economies of scale by purchasing larger, more efficient machines),
3. access to new technology (group purchases can provide individuals faster access to technology that they would otherwise not be able to afford),
4. access to greater pool of knowledge and resources (the pooling of machinery in an organized manner can also facilitate the pooling of other resources, such as labor, experience, and ideas).

One of the major questions about cooperative farming arrangements developed in other social contexts is whether they can be reproduced in different social contexts (Gertler 1981). This fundamental question can be subdivided into two additional questions: (1) what are the characteristics of people who choose this approach to farming, and (2) what are the factors encouraging or discouraging such arrangements? The purpose of this article is to examine existing data from the 1994 North Dakota Rural Life Poll to determine which social, cultural, economic, and farm structural characteristics influence farmers to support sharing machinery or

labor. This article is one part of a project on agricultural production cooperatives being conducted at the Quentin Burdick Center for Cooperatives at North Dakota State University.

Literature Review on Group Farming

In this review, we will focus on those social, cultural, and farm structural characteristics that might incline farmers to join a farm machinery cooperative. In his study of group farming in Saskatchewan, Gertler (1981) found that the operators involved in various forms of production cooperatives included a broad, economic cross section of farmers. Members of the production cooperatives included those who had been medium to small farmers who had been under considerable economic pressure, as well as those who had been larger, more affluent operators who were succeeding alone. Some of the members included those who might have had to leave farming due to capital, health, or other problems. Similarly, some members included those who would not have had an opportunity to enter farming. Therefore, the attractiveness of group operation does not seem to be limited to one size of farm operation. Another study (Elmgren, Brown, and Minogue 1973) of group farms in Saskatchewan hypothesized that farmers were adopting group farming to help cope with some of the problems encountered in developing adequate sizes, assembling risk capital, transferring assets, achieving economies of scale, and adapting to change.

One limiting factor in generalizing from these two studies, however, is that these farms operate in a particular agronomic, economic, political, and social context. As Gertler (1981) mentioned, these farmers were influenced by the recent pioneering history of the area, as well as by the legacy of cooperative and other farmer initiatives. The large-scale, highly mechanized cereal production in which they were involved may also have facilitated group operations.

As Harris (1999) noted, Saskatchewan-style cooperatives, in which production is not pooled and only machinery is shared, seemed to work well under the following conditions: (1) the members share a complete line of machinery rather than individual pieces, (2) they make production decisions independently but share similar production methods, (3) the loss of income from less-than-optimal use of machinery is offset by benefits from joint ownership and use, and (4) they share labor and take advantage of areas of expertise among the members.

On the other hand, Harris (1999) noted that Saskatchewan-style cooperatives in which returns and production are pooled, as well as machinery and equipment, seemed to work well when: (1) the members wanted to share a complete line of machinery; (2) there is greater possibility for conflict regarding machinery use; (3) members were willing to make production decisions collectively; and (4) they want to share labor and take advantage of areas of expertise among the members.

The other type of farm machinery cooperative does not involve sharing a whole set of machinery, but it is structured to allow the sharing of individual machines among sub-sets of cooperative members. This sharing is facilitated through the use of activity branches and member contracts. Harris (1999) hypothesized that this kind of cooperative arrangement should be appropriate to situations where: (1) the members want to share particular machines rather than an entire line; (2) they cannot agree on an equipment selection for the whole group; (3) timeliness issues are small—losses in income are not realized if machinery is not used optimally (i.e., the members are part-time farmers or operations are not time sensitive); (4) members would like to begin sharing machinery gradually, beginning with less-critical or costly equipment because they might not know each other well or want to limit their investments in the cooperative; and (5) they do not share similar production methods.

Gertler (1981) notes that members of a farm machinery cooperative should share a willingness to work together cooperatively; Harris (1999) mentions that members should be compatible with each other. These characteristics were noted by Morneau (1996) where he described the necessary qualities for membership in a limited machinery cooperative:

1. a commitment to helping one another, not only in sharing equipment, but also in planning and organizing work, as well as in making oneself available during times of peak demand;
2. communication with members, including discussing issues and bringing forward problems that could adversely affect the harmony or the environment of trust and mutual respect;
3. respecting the rules that members have developed to govern the operation of the cooperative;
- and
4. a cooperative spirit to assist members in adjusting to cooperative-machinery sharing and to strengthen solidarity because, individualism is a source of conflict.

Harris (1999) also noted the social factors that were essential to the successful formation of a farm machinery cooperative. These included compatibility of the people involved, clear economic benefits, good communications, maintenance of accurate records, written agreements, and appropriate levels of investment. Similarly, Infield (1945, 24–45) found that an absence of a cooperative spirit was an outstanding weakness of Farm Security Administration cooperative farms established in the 1930s. The absence of social capital that comes from sustained interaction among members of a community was noted by McGrath (1996) as one of the problems associated with the establishment of cooperative farms for World War II veterans. Outside of the armed services, few of the veterans who founded cooperative farms had

experienced group living before, nor did they know each other before beginning their joint farming operations. Balancing individual goals and desires with that of the needs of the group was a challenge that was met through democratic decision-making and through member specialization.

Gordon (1976) and Morris (1972) reached the same conclusion in their studies of Saskatchewan production cooperatives. Gordon concluded that members of production cooperatives needed an extensive education program to acquaint them with the principles of cooperation, how cooperatives function, as well as with their advantages and possibilities. Both Gordon and Morris agreed that member-relations difficulties were among the greatest problems that production cooperatives had to overcome. Gordon suggested that member-education programs needed to be founded on the recognition of the importance of human relations, needed to offer practical ways to accommodate individual members' social differences, and needed to improve group-management decision making.

That farm cooperatives are not more extensive than they are and are of limited significance in countries where they do exist may be the consequence of a number of factors including enabling legislation, supportive institutions, and the traditional individualism of farmers (OECD 1971). Regarding the last factor, the OECD (1971) noted that it might act as a brake on the establishment of farming groups. Even in countries that have farm-marketing cooperatives, farmers find the idea of production cooperatives difficult to accept. Although informal cooperative farming arrangements may exist, the formal association of several farmers is the exception. Therefore, formal cooperation can only exist in especially favorable conditions. These conditions have existed in France and Spain (OECD 1971), Quebec (Harris 1999), and Saskatchewan (Gertler 1981). While supportive institutions and enabling legislation are equally

important to the formation of farm machinery co-ops, the individualistic and cooperative tendencies of farmers are important to this article.

In France, the farm machinery cooperative movement owed its origin to a certain idealism of the farmers who established the groups which when combined with a high level of education overcame their individualistic tendencies (OECD 1971). The pressure of adverse economic circumstances in Spain left farmers with no other alternative, forcing them to discard their individualism. The apparent success of the limited machinery co-ops in Quebec can be attributed to a number of reasons including direct economic gains to individual-producer members, previous experience with cooperatives and other farm machinery arrangements, clearly defined organizational structure and limited personal liability, substantial support from various external organizations, community development gains, and the “human factor” (Harris and Fulton 1999a).

Informal cooperation between farm families has always been an important social and economic phenomenon on the Northern Plains (Bennett 1969). Saskatchewan has a long history of agrarian cooperation and cooperative movements (Lipset 1950). Formal cooperation in production-related activities is not unfamiliar in Saskatchewan. These activities include grazing co-ops, feeder co-ops, and single-purpose machinery co-ops. Formal cooperative activities have been supported by the Canadian Farm Credit corporation, which makes loans available to groups or “syndicates” of farmers for the purchase of equipment that might be used in common (Farm Credit Corporation 1979). The researchers who evaluated group farming in Saskatchewan (Elmgren, Brown, and Minogue 1973) hypothesized that this form was adopted to help overcome some of the problems being encountered in developing adequate units, assembling risk capital, transferring assets, achieving economies of size, and adapting to change. Many of the machinery

cooperatives were formed in the 1970s with help from the Saskatchewan Department of Cooperation. The primary motivation, according to Harris and Fulton (1999b), was to reduce machinery costs by being able to jointly purchase larger, more efficient machines or by being able to purchase machines that individuals could not afford alone.

Theoretical Orientation

This research is informed by the middle-range theory on the adoption and diffusion of innovations (Rogers and Shoemaker 1971, 85-91). As a theory, it is not as abstract as grand theory, which is almost impossible to translate into empirically testable hypotheses. Nor is it as atheoretical as raw empiricism, which does little to generalize beyond the particular respondents or the social systems studied. A middle-range theory attempts to relate theory to research and research to theory. This means that the theoretical basis must be empirically testable, and the data must test theoretical hypotheses.

The joint processes of deduction and induction relate the theoretical and empirical levels. We begin with the theoretical hypotheses about the relationships among concepts, develop empirical measures for the concepts, collect data to test the relationship among the variables, and generalize from the results back to the theoretical level. The goal of middle-range theory is to eventually develop an interrelated, integrated series of concepts linked in a matrix of theories and of established relationships. The hope is that these middle-range generalizations would be intermediate to more general theories of social change when they are abstracted to a higher level of generality.

Ideational Innovations and Symbolic Adoption

Sharing labor or machinery is an innovation in the current context of northern Great Plains agriculture, but one that has historical precedence in actual practices of informal labor sharing before and during early phases of agricultural mechanization and in threshing rigs of the early 20th century. An innovation is defined as “an idea, practice, or object perceived as new by an individual (Rogers 1979, 19). Whether the innovation is actually new is not as important as is its perceived newness for the person adopting it. If it seems new to the person, it is an innovation. An innovation can be a technology, a practice, knowledge, or a belief. Most research on the adoption of innovations has considered them to be material or technological, involving an object and an idea. All innovations have an ideational component, but not all have an objective component.

Whether or not farmers would be willing to share labor or machinery relates more to their willingness to consider adopting a concept rather than an actual practice. Labor and machinery sharing is more of concept or an idea than it is an actual practice. Few farmers are aware of the actual organizational forms by which labor or machinery may be shared. For the most part, this sharing of labor or machinery involves the willingness to consider an abstract idea. Innovations that have only an idea component cannot be adopted in a way that can be physically observed. In these instances, adoption is basically a symbolic decision (Rodgers and Shoemaker 1971, 21; Klonglan and Coward, n.d.).

Attributes of Innovations and Adoption

There are five attributes of innovations that facilitate their adoption (Rogers and Shoemaker 1971, 22–23). They are relative advantage, compatibility, complexity, trialability, and observability.

Relative advantage, the first characteristic, refers to the extent to which an innovation is seen as being better than the idea it replaces. It may be measured in economic terms, social prestige, convenience, and satisfaction. The actual “objective” advantage of the innovation is less important than is the “perceived” advantage. The idea of machinery and labor sharing would seem to have some perceived relative advantage in the reduction of fixed costs, greater efficiency of use, and greater specialization of labor. It may, however, have some perceived relative disadvantage in the loss of independence.

Compatibility, the second attribute, refers to the extent to which the innovation is seen as being consistent with existing values, past experiences, and needs of the potential adopters. While sharing labor and machinery would seem to be inconsistent with the high value placed on freedom by farm operators, they would be familiar with the idea of cooperation through their participation in the various supply, marketing, and value-added cooperatives to which they may belong. The idea may also be compatible with their past experiences when they call upon their historical memory of when such practices were more common than they are now. Sharing labor and machinery might also seem to be compatible with their needs as they consider the high costs of machinery and the unavailability of competent farm labor.

The third attribute, *complexity*, refers to the extent to which an innovation is seen as being difficult to understand and use. The idea of machinery and labor sharing would not seem to be conceptually difficult; although, the actual organizational practices involved in accomplishing it

are complex. The complexity of the idea would seem to be reduced through the recall of historical memory when practices of informal labor and machinery sharing were common.

The fourth characteristic, *trialability*, refers to the extent to which an innovation may be tried on a small scale. This attribute of innovation applies more to the objective component of an innovation rather than the ideational component. New organizational forms of cooperative labor and machinery sharing make trialability easier.

Observability, the last attribute, refers to the extent to which the results of the adoption of an innovation are visible to others. When people can easily see the results of the adoption of the innovation, they are more likely to adopt it. Again, this characteristic refers to the objective component of an innovation rather than the ideational component. Given that we are dealing with symbolic adoption of cooperative farming, the observability attribute is not applicable.

Characteristics of Early Adopters

Based on a review of adoption and diffusion of innovations research publications, Rogers and Shoemaker (1971) developed a number of generalizations regarding the relationship of various independent variables to innovativeness. They grouped them under those relative to socioeconomic status, personality traits, and communication behavior. Based on the previous literature review and the measures available in the data, the characteristics most relevant will be cited here. In regard to their *socioeconomic characteristics*, earlier adopters are **assumed then to** be no different from later adopters in age, have more years of education, have higher social status, and have larger-sized units. In regard to their *communication behavior*, earlier adopters

tend to have more social participation, are more highly integrated with the social system, and are more likely to belong to well-integrated systems.

System Characteristics

Innovation has been found to be higher in social systems that have norms that encourage individuals to adopt innovations. This phenomenon has been identified as “system effects.” The basic idea is that the norms, social statuses, hierarchy, and so on, of a social system affect how individuals in that system behave. System effects are the influences of the system’s social structure on the behavior of the individual members of the social system. They exert an influence on individual adoption behavior independent of individual characteristics. This phenomenon has also been called structural effects (Blau 1960, 178–193), compositional effects (Davis et al. 1961), and contextual effects (Riley 1963). Other applications of system effects to adoption behavior include Saxena (1971 and 1972), Marsh and Coleman (1956, 588–594), Young and Coleman (1956), Van den Ban (1960, 309–320), Flinn (1970, 983–991), Francis (1974), and Stofferahn and Wagner (1982).

In social systems where cooperative membership, belief, and support for cooperatives are high, we would expect individuals to adopt cooperative farming at a higher rate regardless of their own cooperative membership, support, or belief. In social systems where cooperative membership, support, and belief are low, we would expect producers to be less willing to adopt cooperative farming.

Theoretical Hypotheses

Based on the literature review, it is not clear whether those operators with larger farms, more years farming, greater farm income, greater length of operation of a farm, or who are older would be more willing to adopt cooperative farming, but the review does suggest that those farmers who have more education would be more willing to adopt cooperative farming.

Based on the theory of the adoption and diffusion of innovations, however, we would hypothesize that those farmers with larger farms, higher farm and family incomes, and more education would be more willing to adopt cooperative farming. As neither the literature nor theory suggested any particular direction in regard to age or years farming, we hypothesize that there would be no difference among farmers in terms of willingness to adopt cooperative farming. The literature review suggests that those farmers who are members of cooperatives, have a commitment to cooperative philosophy, and who support cooperatives would be more willing to adopt cooperative farming. Finally, farm operators who reside in areas with higher support for cooperatives, higher involvement in cooperatives, and higher support for cooperative philosophy would be more likely to adopt cooperative farming than those farm operators living in areas where the support, agreement, and membership were less favorable. This hypothesis is in keeping with the idea of systems effects discussed previously.

Data

The North Dakota Rural Life Poll is a periodic, statewide, mailed survey of North Dakota's rural residents. The poll is a panel study of those respondents who were randomly selected to participate in the first poll in 1987. Questionnaires were mailed to two target groups: farm

operators and small town residents. The sampling frame for rural, non-farm residents was telephone directories for all counties except the five urban counties. The sampling frame for farm operators was initially drawn from the list of farmers in each county of North Dakota who participate in the commodity programs of the Agricultural Stabilization and Conservation Service of the U.S. Department of Agriculture supplemented by subscribers to the *Farm and Ranch Guide*. The poll was conducted during the spring and summer of 1994. Only the results of the farm operators' poll are used for this analysis. The margin of error for farm respondents is 4.75 percent (N=425).

Measures

Dependent Variable

Willingness to adopt cooperative farming is measured by farmers' willingness to share equipment or labor. The question asked in the farm operators' poll was "Would you be willing to share labor or machinery with your neighbors?" The responses to the question were check/not checked. Only 46 (10.8 percent) of the 425 respondents checked the box to indicate that they would be willing to share machinery or labor.

Independent Variables

To preserve as much of the data as possible for analysis, we replaced missing values for the variables in each case with the mean value for those variables.

Total Acreage was determined by adding together *acreage owned* and *acreage rented* for each respondent.

Gross Farm Sales was measured by asking respondents to identify the income category that contained their gross farm sales for the last year. The response categories were less than \$5,000, \$5,000 to \$9,999, \$10,000 to \$24,999, \$25,000 to \$39,999, \$40,000 to \$49,999, \$50,000 to \$99,999, \$100,000 to \$249,000, \$250,000 to \$499,999, and \$500,000 and more.

Age was measured by actual number of years.

Years Farming was measured by asking respondents to list the number of years that they had been farming.

Education was measured by asking respondents to check the box most appropriate to their educational attainment. The categories were seven years or less, eight to eleven years, high school graduate, some college-vocational school, four-year college degree, and post-graduate degree. The categories were coded one through six, respectively.

Political affiliation was measured by asking respondents to identify the political party with which they were more closely identified. The choices were conservative republican, moderate republican, liberal republican, independent but closer to republican, independent, independent but closer to democrat, conservative democrat, moderate democrat, liberal democrat, or other. The categories were coded two through ten, respectively. This variable was included as a proxy for individualism/collectivism. Our assumption was that:

1. democratic affiliation would indicate a preference for progressive change, advocacy of government and state intervention in the economy, and belief that individuals can work together to solve problems;

2. independents would reject drastic changes because they are satisfied with the status quo and believe that change should be gradual; and
3. republicans would be supportive of the existing system, would be skeptical about the ability of individuals to cooperate to solve common problems, would not favor intervention in the economy by the state, and would favor individualistic solutions to problems (Kourvetaris 1997).

Total Family Income was measured by asking respondents to identify the category in which their total family income lay. The categories were less than \$5,000, \$5,000 to \$9,999, \$10,000 to \$14,999, \$15,000 to \$24,999, \$25,000 to \$34,999, \$35,000 to \$49,999, \$50,000 to \$74,999, \$75,000 to \$99,999, \$100,000 to \$149,000, and \$250,000 or more. The categories were coded one to ten, respectively.

A measure of *cooperative involvement* was created by summing responses to questions about respondents' membership relating to:

1. doing some or all of their business with the co-op,
2. attending annual meetings, or
3. being a member of the board of directors in farm marketing, farm supply, farm credit, credit union, rural electric, rural telephone, rural water, commodity processing, and consumer co-ops.

If they had no involvement, each was given a zero; if they were a member they were coded as one; if they did some of their business with that co-op they received a two; if they did all of their

business with that co-op they were given a three; if they attended the annual meeting of that co-op they were given a four; and if they were a member of the board of directors of that co-op they were given a five. The responses of none, some, all, attend, and board **were** summed to arrive at a measure of cooperative involvement. The theoretically possible range for this variable is 0 to 135.

The measure of *cooperative philosophy* was created by summing respondents' answers to a number of questions that attempted to determine the extent to which they agreed with basic premises of cooperation as embodied in the Rochdale principles. These include open and voluntary membership, democratic control, limited interest on shares, return of surplus to members, cooperative education, and cooperation among cooperatives. The responses were "not important," "important," and "very important," and were coded zero, one, and two, respectively. The theoretically possible range for this variable is 5 to 25.

Cooperative support was measured by adding responses to the following statements:

1. Co-ops need my support to survive,
2. I don't have much influence in my co-op,
3. Co-ops are less important now than before,
4. There is little difference between co-ops and other businesses,
5. Co-ops provide better prices,
6. Co-ops provide better services,
7. Co-ops provide better products,
8. Co-ops should promote economic development, and
9. We need more agricultural processing co-ops.

Responses were coded strongly agree, agree, undecided, disagree, or strongly disagree, and were coded five through one, except for the second, third, and fourth questions, which were reverse coded. The theoretically possible range for this variable is nine to forty-five.

The descriptive data for the measures are provided in Table 1.

<Table 1 About Here>

Analysis

One-Way Analysis of Variance

Using one-way analysis of variance, we attempted to determine whether those who were willing to share machinery and labor were significantly different from those who were not on previous indicators. The null hypothesis is that there were no differences between those who were and were not willing to share machinery and labor. The results are presented in Table 2.

<Table 2 About Here>

The only significant differences between those who would and would not be willing to share machinery and labor were with acres owned, educational attainment, age, and cooperative involvement. While mean education was significantly different between those willing and not willing to share, it was not substantively significant as there was just one year of difference

between the categories. Those who were willing to share machinery and labor rented more land, had more education, were slightly older, and were more involved in cooperatives. Neither the means for cooperative support nor cooperative philosophy were significantly different for those who were willing or not willing to share machinery or labor. The coefficient of relative variation and the means on these two variables (Table 1) indicate relatively high agreement on cooperative philosophy and high amounts of support for cooperatives with little relative variation. Therefore, neither of these would distinguish those who were willing to share machinery and labor from those who would not.

Discriminant Analysis

To further examine the relationship among the variables and willingness to share labor or machinery, we examined the extent to which they can distinguish between those who are willing to share and those who are not willing to share. To do this we used stepwise discriminant analysis to see how well the predictor variables could classify cases into the two categories. In the first step, only age was entered in the analysis. Political affiliation was entered in the second step, and cooperative involvement was entered in the third step. The discriminant analysis was able to classify 67 percent of the cases correctly: 68 percent of those not willing to share, and 59 percent of those willing to share. The results are displayed in Tables 3 and 4.

<Tables 3 And 4 About Here>

Logistic Regression

Finally, we were interested in the extent to which our variables could explain whether or not respondents would be willing to share labor or machinery. Because the dependent variable is dichotomous, we used logistic regression. In the first model, we entered the systems effects variables—cooperative support, cooperative involvement, and cooperative philosophy—in a forward stepwise manner. The second model included farm structural characteristics—total acres farmed, acres owned, acres rented, and gross farm sales—in addition to the significant variables from the first model, again entered in a forward, stepwise method. The third model included farm operator characteristics such as age, education, years farming, net family income, and political party preference, in addition to the variables from the second model. In each succeeding model, only those variables that the forward-stepwise-enter procedure found to be significant in previous model(s) were entered in the next model.

<Table 5 About Here>

In the table, only the unstandardized Betas of those variables that the forward stepwise regression procedure found to be significant at each step are reported, in addition to the odds and the log likelihood, the chi square goodness of fit for the model, and the percentage correct for the model.

The odds ratio is the number by which we would multiply the odds of being willing to share machinery increases for each one-unit increase in the independent variable. The unstandardized logistic regression coefficient (Beta) is the logit (Y), which can be described as the logged odds of being in the higher category (would not consider sharing machinery and labor) dependent variables versus the lower category (would not consider sharing labor and machinery). In this case, the Beta is the logged odds of willingness to share machinery and labor. It can be

interpreted in a way similar to an ordinary least squares regression coefficient, that is, the standard deviation change in the logit of Y (willingness to share machinery and labor) associated with a one-unit change in the independent variable (Menard 1995). The chi-square goodness of fit is analogous to the multivariate F test (regression sum of squares) for linear regression and tests the null hypothesis that $B_1=B_2=B_3=B_k=0$ for the logistic regression model. If the model X^2 is statistically significant ($p < .05$), then we reject the null hypothesis and conclude that information about the independent variables allows us to make better predictions of the probability of the dependent variable than we could make without the independent variables.

In the first model involving the systems effects variables, only cooperative involvement was significant among the variables entered. The log of the odds indicates that a one-unit change in cooperative involvement would bring about a 1.0979 change in willingness to share machinery and labor. The chi square goodness of fit test was significant, meaning that the information about cooperative involvement allows us to make a better prediction of the probability of being willing to share machinery or labor than without it. The overall model classified 89.18 percent of the cases correctly.

In the second model incorporating farm characteristics, only acres rented was significant in the forward, stepwise regression model. The relatively small size of the unstandardized Beta and the small odds ratio indicates that the odds of being willing to share machinery and labor would improve by only 1.001 times for each one-unit increase in acres rented. The chi square goodness of fit test was significant, meaning that the inclusion of acres rented and co-op involvement allowed us to make a better prediction of the probability of being willing to share machinery and labor than without them. The overall model classified 88.94 percent of the cases correctly, a gain of a mere one hundredth of a percent.

In the third model, which included the farm operator characteristics, only education was found to be significant in the forward, stepwise regression procedure. The odds ratio (1.4459) indicates that a one-unit change in education would have a 1.4459 increase in willingness to share machinery or labor. The chi square goodness of fit test was significant, indicating that the inclusion of education, acres rented, and co-op involvement permitted us to make a better prediction of the probability of being willing to share machinery and labor than without them. The percentage of cases correctly classified did not change.

Conclusions

From the literature and theoretical review, we hypothesized that a number of variables would distinguish those who were willing to share machinery and labor from those who were not. We developed twelve empirical hypotheses and used a one-way analysis of variance to test them. The results indicated that those who rent more land, have more education, are slightly older, and are more involved in cooperatives would be more willing to share machinery or labor. None of the means of the other variables were significantly different between the two categories. Thus, four of the twelve empirical hypotheses were supported, and the results are largely consistent with the theory of adoption and diffusion of innovations.

One reason that neither cooperative philosophy or cooperative support distinguished between the two categories was that there was little variation on these two variables, and the means for both were relatively high. The lack of variability on these measures indicates that cooperative support and philosophy are indicators of systems effects. That this occurred should not be surprising as cooperative philosophy and support for cooperatives are part of the North Dakota agrarian creed. Given that there was little variation on the measures of cooperative

philosophy and cooperative support, we did not think that these two measures would provide any explanatory power.

After attempting to determine whether those who were willing or unwilling to share machinery or labor were significantly different from each other, we were interested in how well the independent variables we selected were able to classify or predict the dependent variable. We used discriminant analysis to determine if the variables we selected could classify cases into either willing to share or not willing to share machinery or labor. The only variables that had any classificatory power were education and cooperative involvement. We had expected that both education and cooperative involvement would have classificatory power as we had discovered in the one-way analysis of variance that the two groups were significantly different on these two measures. The final model correctly classified 59 percent of the cases—68 percent of those not willing to share and 41 percent of those who were willing to share machinery and labor.

Finally, we attempted to determine whether three sets of independent variables—farm structural characteristics, farm operator characteristics, and attitudinal and normative characteristics—could predict respondents' willingness to share machinery or labor. Using a forward, stepwise logistic regression procedure, with the variables from previous regressions entered in each succeeding model, we discovered that acres rented, education, and cooperative involvement were the only variables that significantly predicted willingness to share labor or machinery. Of the three variables, education had the largest predictive ability, followed by cooperative involvement, and then acres rented. Education increased the odds of willingness to share by almost one and a half times, while cooperative involvement and acres rented did not appreciably increase the odds.

Implications

What do these results indicate for those who would attempt to organize farm-machinery-sharing cooperatives? If an organizer employs a social marketing perspective, he/she would target those who are already cooperative members, those who rent more land, and those who have more education. These characteristics fit the profile of the innovator or early adopter (Rogers and Shoemaker, 1971).

Those who are already involved in cooperatives would be more inclined to consider the idea of a farm-machinery-sharing cooperative. Those with more education would be more inclined to consider a farm-machinery-sharing cooperative because they would have the ability to deal with the abstract idea of cooperative farming. Those who rent more land might be more interested in farming cooperatively as they know from experience that spreading fixed-asset costs over a larger acreage would reduce the costs of those assets on a per-acre basis.

After identifying the target audience of potential adopters, a cooperative organizer could address the characteristics of the innovation itself that would lend themselves to favorable consideration by the potential adopters. Among these characteristics are compatibility, complexity, trialability, and relative advantage (Rogers and Shoemaker, 1971).

That a farm-machinery-sharing cooperative is compatible with their previous experiences as cooperative members should be highly stressed. Their experience with marketing; supply; or new-generation, value-added cooperatives would favorably predispose them to considering the idea of cooperative farming. Their experience with these kinds of cooperatives, however, may not be directly transferable to farm-machinery-sharing cooperatives, as the former require less

surrender of individual decision making than would the latter. Potential adopters who are more highly committed to cooperative philosophy, however, would be more likely to surrender some of their individualism if the relative advantages of joining a farm-machinery-sharing cooperative were greater than the disadvantages.

A farm-machinery-sharing cooperative is a complex innovation requiring extensive coordination among all members in regard to planting, cultivation, and harvesting schedules as well as maintenance, repair, and replacement of equipment. These complexities have to deal not only with the formal aspects of organizing the cooperative, but also with the behavioral changes involved in sharing machinery. To that extent, a cooperative organizer would have to provide examples of successful farm machinery cooperatives and how they addressed these issues. Most successful farm machinery cooperatives have employed an accountant to do their bookkeeping, and each member also keeps a logbook of daily information as to use of equipment. They also have written agreements that help them understand the workings of the cooperative and their rights and responsibilities. Most of this information is found in the bylaws.

The behavioral changes required of members may be the most complex part of adopting this innovation. These include:

1. a commitment to plan and organize work to facilitate the cooperative;
2. communication among members;
3. the ability to discuss issues and bring forward any behavior problems that could cause loss of mutual respect and trust;
4. respect for the rules drawn up by the members to ensure the proper functioning of the cooperative;

5. helping members to adjust to the cooperative method of sharing farm machinery and to helping them to reinforce solidarity;
6. sharing experience among members, especially with respect to new technologies and equipment operations; and
7. realizing the full potential of the cooperative while keeping it personable.

If potential adopters are apprehensive about becoming members of a full machinery-sharing cooperative, the organizer can suggest that they try a smaller-scale version by choosing one piece of equipment, usually one that is rather specialized or of limited use, and agreeing to share it. The organizer can point to the limited farm machinery cooperatives in Quebec and in France as models. After they become accustomed to sharing one piece of equipment, they can gradually branch out into other pieces of equipment as need arises to retire aging machinery.

The relative economic and social advantages of sharing farm machinery through a cooperative structure are considerable. An organizer can more readily demonstrate the economic advantages through farm-financial modeling. These include:

1. sharing financial risks and minimizing individual investments,
2. ensuring the most efficient use of invested capital and reducing operational costs,
3. allowing for the purchase of more efficient and powerful machinery,
4. favoring shorter equipment turnover periods in order to obtain a higher resale value,
5. lower financial commitment for beginning farmers,
6. reducing labor demands through use of larger, more efficient machinery,

7. allowing members to use machinery specifically suited to meeting the needs and conditions for expansion,
8. freeing up scarce funds that would be better applied to other areas such as expansion and diversification,
9. and eliminating unproductive capital assets.

The relative social benefits of sharing farm machinery through a cooperative structure are less demonstrable. These include developing a sense of neighborliness among participating members, sharing experiences and skills among members with respect to new technologies and equipment operations, and labor sharing among members.

Finally, an organizer would be more likely to be successful in organizing a farm-machinery-sharing cooperative in an area that has a high density of cooperatives and cooperative memberships because of the presence of systems effects; that is, in communities where cooperative membership and belief, and support for cooperatives are high, we would expect individuals to adopt cooperative farming at a higher rate, regardless of their own cooperative membership, support, or beliefs.

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Table 1. Descriptive Statistics for the Measures

Measure	Range	Mean	Variance	Std. Dev.	CRV	Alpha
Cooperative Philosophy	6 – 18	13.5	.00	2.2	21.7	.78
Cooperative Support	9 – 36	30.3	33.7	5.6	19.4	.82
Cooperative Involvement	0 – 23	9.9	23.0	4.8	48.5	.75
Years Farming	0 – 79	27.0	338.3	18.4	68.1	NA
Acres Rented	0 – 21,000	612.5	1,892,925	1,375.8	224.6	NA
Acres Owned	0 – 20,000	805.2	2,179,010	1,476.1	183.2	NA
All Acres	0 – 41,000	1,417.7	6,226,509	2,495.3	176.0	NA
Education	2 – 8	4.9	2.3	1.4	30.0	NA
Age	17 – 96	46.4	22.6	15.0	30.0	NA
Total Family Income	2 – 11	7.0	4.1	1.8	31.2	NA
Gross Farm Sales	2 – 10	6.5	4.0	2.0	30.8	NA
Political Affiliation	2-11	5.6	4.7	2.2	39.1	NA

Table 2. One-Way Analysis of Variance

Variable	Prob.	Would Share Mean	Would Not Share Mean	Conclusion
Total Acres	.123			No significant difference
Acres Owned	.504			No significant difference
Acres Rented	.038	1419	863	Those willing to share rent more land
Gross Farm Sales	.468			No significant difference
Years Farmed	.316			No significant difference
Political Affiliation	.189			No significant difference
Educational Attainment	.000	5.65	4.84	Those willing to share have more education
Age	.033	47	46	Those willing to share are older
Total Family Income	.341			No significant difference
Cooperative Philosophy	.968			No significant difference
Cooperative Involvement	.006	11.74	9.69	Those willing to share are more involved in co-ops
Cooperative Support	.979			No significant difference

Table 3. Discriminant Analysis

Step	Entered	Wilk's Lambda	Sig.
1	Education	.96604	.0001
2	Co-op Involvement	.95354	.0000

Table 4. Classification Results

Actual Group	No. of cases	Predicted	Not Predicted
Would not share	379	258 68.1%	121 31.9%
Would share	46	19 41.3%	27 58.75%

Percent of "grouped" cases correctly classified: 67.06%

Table 5. Unstandardized Logistic Regression Coefficients (Beta), Log of the Odds (Odds), Log Likelihood (-2LL), Chi Square Goodness of Fit (Chi Sq.), and Percent Correctly Classified (% Correct)

Step	Variables	Beta	Sig.	Odds	Chi Sq. Sig.	%Correct
1	Constant	-3.1107	.0069		.0055	89.18
	Co-op Involvement	.0934	.0000	1.0979		
2	Constant	-3.2295	.0000		.0891	88.94
	Co-op Involvement	.0947	.0067	1.0993		
	Acres Rented	.0001	.0789	1.0001		
3	Constant	-4.9971	.0000		.0011	88.94
	Co-op Involvement	.0815	.0206	1.0849		
	Acres Rented	.0001	.1716	1.0001		
	Education	.3688	.0012	1.4459		