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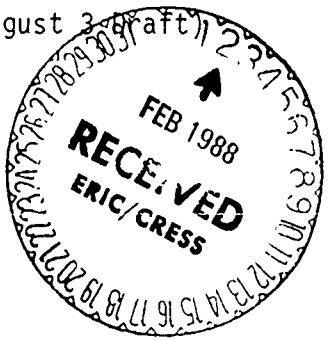
ABSTRACT

The extent to which conditions and experiences of the farm crisis have tempered or shaped farm operators' opinions about the role of the scientific community in economic development through university-industry linkages is examined in this paper. Eleven Likert-type items, designed to ascertain how these linkages are viewed, were included in the 1987 Iowa Farm and Rural Life Poll. Farmers' opinions were assessed on how much collaboration is desirable and the desired role of the private sector in selecting problems to be studied. The hypotheses were that economic hardship, scientific orientations, economic development perspectives, and personal sociodemographic characteristics would be important predictors. Findings showed that farmers generally supported stronger university-industry linkages, and agreed that scientific research is determined by who can pay, rather than what is needed. Mixed opinions were held on how new discoveries should be made available, and whether the amount of private consulting by university scientists should be curtailed. The 11 attitudinal items factored into 4 scales with low reliability coefficients, in part due to the limited number of items in each factor. It was concluded that although farmers are generally supportive of university-industry linkages, it is too early to accurately predict whether future support will be sustained. (JMM)



Farmers' Opinions on the Relationship between Land Grant Colleges and Private Industry

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Introduction

The immediate impacts of the farm crisis are just now being understood and reported in the scientific literature (Rural Sociology, Vol. 51, No. 4, 1986). Recent journal articles, departmental monographs and professional papers have documented many of the short-run consequences of the farm crisis. Unfortunately, the longer-term consequences have largely escaped scientific attention. However, there is growing discussion on how the farm crisis may likely accelerate the trends that are responsible for the restructuring farming and rural life. Drawing upon Kuhn's (1970) notion of paradigm shift, we recently argued that the experiences of the farm crisis would result in farm families questioning and perhaps reassessing the dominant values and beliefs that contributed to the trends leading up to the farm crisis (Bultena, et al, 1986).

In this paper we explore how conditions and experiences of the farm crisis have tempered or shaped farm operators opinions about the role of the scientific community in economic development through university-industry linkages.

Since 1980, Iowa's economy, like that of other midwestern states, has been staggered by a set of forces that has shook the foundation of the agricultural industry. In previous analysis, we argued that the farm crisis is more accurately described as a chronic problem (Lasley and Phillips, 1987; Lasley, 1987). A plethora of research has been conducted on the severity of the farm crisis (Lasley, 1987; Bultena et al, 1986; Heffernan and Heffernan, 1986). Less-studied are the longer-term questions such as how agriculturally dependent states can rebuild their economies and how the farm crisis has contributed to new institutional linkages.

The severity of the farm crisis has contributed to a recognition of the need for economic diversification (Hoiberg and Lasley, 1986). During the 1970s, agriculturally dependent states enjoyed rapidly rising land values, strong

economies because of export demand for U.S. farm products and often believed their economies were recession proof. However, the events of the past decade have once again reminded state leaders that a specialized economy is more volatile than a diversified one.

As agriculturally dependent states have begun to "dig out" of the economic shambles of the farm crisis, they have often sought new approaches to rural economic development. Since World War II, Sher (1986) argues that there has been five dominant rural development strategies. According to Sher, these are:

1. Infrastructure development -- construction of roads, extension of service and utilities, industrial parks, etc.
2. Agribusiness -- emphasizing large scale, capital intensive, industrial farming made possible by corporate ownership and vertical integration.
3. Industrial recruitment -- attracting industry and manufacturing to rural areas.
4. Natural resource extraction and processing -- including mining, petroleum, fisheries, forestry.
5. Tourism and Recreation -- including vacation and resort areas, second homes and retirement communities, etc.

Iowa is attempting to rebuild its economy through pursuing each of these strategies. Because of its unique position and heavy dependence upon agriculture, Iowa leaders are placing heavy emphasis upon agricultural high-tech research and development. Agro-high tech is viewed by many as the solution to the states economic ills. Drawing upon the experiences of other states that have rebuilt their economies on high technology such as Massachusetts, California, and North Carolina, Iowa leadership is aggressively promoting economic development by combining agribusiness and industrial recruitment. The centerpiece of Iowa's agro-high technology strategy is biotechnology. Much of the emphasis in this approach is to link the scientific community to economic

development concerns. Iowa's colleges and universities are central to this economic development strategy. The universities are viewed as major engines of economic development through the discovery of new processes, products and systems that will launch an economic recovery. In another paper we explore farmer's opinions on biotechnology and examine what farmers expect from this new science (Bultena and Lasley, 1987).

Iowa State University has been aggressively seeking new resources to spur economic development. In 1986, the Legislature appropriated $17 million for bio-tech research at ISU. In 1987, an additional $35 million was appropriated to build a molecular biology center. In addition, efforts to establish a research park for private companies to locate on the fringe of the campus are underway. An incubator program has been established and has successfully graduated its first start-up businesses. Retention and expansion programs, entrepreneurial training programs, and a mainstreet development program among existing community resource development programs have been added by the Cooperative Extension Service.

Each of the development strategies being pursued encourage, if not require, closer ties between the university and private industry. The university administration, legislative leaders, and business leaders have been quite vocal in their support for more collaboration and interaction between the scientific community and business-industry sectors.

However, this strategy is not without risk. The history of university and private sector linkages is marked by sharp opposing views (Marcus, 1985; Busch and Lacy, 1986). Hightower (1973:28) argues that land grant colleges should be held to the standards of public service for all people, rather than "tax paid clinics for agribusiness." Others have warned of the hazards of being too closely identified with corporate interests (Schuh, 1986; Mawby, 1985). The risks of ignoring public demands to spur economic development or being too

closely identified with business interests has lodged universities between a "rock and a hard place." To ignore the urgent needs of creating employment opportunities in depressed agriculturally dependent communities will certainly lead to charges of not being relevant and undermine public trust. On the other hand, to exclusively focus on the needs of industry and business runs the risk of being condemned as "health care clinics for corporate America," which may also undermine public confidence.

Methods

To ascertain how farmers view the relationship between land-grant colleges and private industry, several questions were included in the 1987 Iowa Farm and Rural Life Poll. The response rate to this mail survey was 55 percent. This analysis relies upon panel data collected in the 1984, 1986, and 1987 Iowa Farm and Rural Life Poll. Only the 752 respondents who participated in all three years of the panel study are included in the analysis. comparing the panel respondents with the 1982 Census of Agriculture, the sample is an accurate depiction of Iowa farms with the exception of the under-enumeration of small farms (less than 50 acres) and under-represents farmers less than 25 years old.

Dependent Variables

In the absence of validated measures of university-industry linkages, we developed 11 Likert-type items designed to tap how farmers view linkages between the university and private industry. These items were designed to assess farmers' opinions on how much collaboration is desirable and the desired role of the private sector in selecting problems to be studied (Table 1).

Independent Variables

We hypothesize that four sets of variables would be important predictors of farmers' opinions toward university-industry linkages. These four sets of variables include measures of economic hardship, operator's scientific

orientations, farmers' economic development perspectives and personal socio-demographic characteristics.

Economic Hardship

We predicted that the level of financial distress or economic hardship would be positively related to support for university-industry linkages. The rationale is that those farm families experiencing high levels of financial distress would be most supportive of collaborative activities that promise economic recovery. Since the push towards encouraging more university-industry ties has promised a renewal of the state's economy, we hypothesized that financial distress would be positively related to levels of support for university-industry collaboration.

Economic hardship was operationalized from three indicators which included: 1) perceived deterioration of quality of life for own family for the past five years and projected deterioration of family's quality of life in the next five years; 2) level of concern about farm's financial condition and 3) debt-asset ratio for January, 1986. The quality of life indicators were coded "1" - become much better to "5" - become much worse. The alpha reliability coefficient for this scale was .64 (Table 2). Level of financial concern about their own farm ranged from "1" - not concerned to "4" - very concerned. The third indicator of economic hardship was respondent's debt-asset ratio on January, 1986. This measure ranged from 0 (no debt) to over 100 percent.

Scientific Orientation

Based upon several indices of farmers' scientific orientation previously reported (Lasley and Bultena, 1986) we predicted that farmers who hold a "faith in service" in solving problems would be more supportive of university-industry linkages.

From the spring 1984 survey, a set of 12 attitudinal items were used to assess respondent's opinions on the future role of the university. These items produced three factors of acceptable reliability. These factors are agreement on the need for agricultural research programs (Greater Need, alpha = .77); university research is more creative (Creative Research, alpha = .65); and expressions of the need for the Cooperative Extension Service, alpha = .60 (Table 3).

Economic Development

Farmers' preferences for economic development are from a set of questions that were asked in the spring 1985 Iowa Farm and Rural Life Poll in which respondents could check whether they strongly supported to strongly opposed several development strategies. These data were reported by Powers and Lasley (1986). The scale, Economic Development, contained four items: support for attracting high technology industries; emphasizing more manufacturing jobs in nonagricultural industries; providing tax incentives for businesses to locate in state; and emphasizing retention and expansion of existing industries. Response categories were coded "1" - strongly oppose to "5" - strongly support. This scale had a alpha coefficient of reliability of .73. We predicted that support for this economic development strategy would be positively related to support for university-industry linkages.

Findings

Descriptive Statistics

Table 1 provides the descriptive statistics on the eleven items designed to ascertain opinions on university-industry linkages.

The distribution on the first three items suggests that farmers are supportive of stronger university-industry linkages. Approximately three-fourths agreed that more linkages are needed, that these ties should be encouraged and that industry input will improve university research.

Respondents generally agreed that scientific research is determined by who can pay rather than what is needed by society. Nearly eight of ten agreed with this statement. Somewhat consistent with this position is that 50 percent agreed with the statement that university scientists are often more interested in helping private industries rather than serving the state's citizens. An apparent distrust of university scientists was expressed among the 56 percent who disagreed that scientists, rather than the agribusiness community, should determine what types of problems need to be investigated. Nearly one-half (49%) disagreed that scientists should select problems based upon scientific criteria rather than whether it would benefit from economic development.

Two items were included that focus on how the university should handle patents and restrictions on new products. Farmers held a mixed opinion on how new discoveries should be made available. Thirty-nine percent agreed that new discoveries should be patented by the university and sold to the highest bidder, however, 34 percent disagreed with this position and 27 percent reported they were uncertain. Farmers were quite divided on whether new discoveries be made available to any company that wished to market them. Forty percent agreed that new discoveries be made available without restriction, where 37 percent disagreed, and 23 percent were uncertain.

Farmers were divided on whether the amount of private consulting by university scientists should be curtailed. Twenty-five percent agreed that consulting should be curtailed, 31 percent disagreed, and 44 percent were uncertain. Three-fourths of the respondents agreed that more public funds should be used to support the development of new uses for agricultural commodities.

When the 11 items were subjected to principal component factor analysis, four factors emerged with eigen values greater than 1.0. The first factor

labeled LINK included the three items on the benefits of university-industry. A second factor, labeled PAY, included two items on how research priorities are made and who benefits from science. A third factor (AUTON) included three items on who should select research problems, reflecting the degree to which the university should be autonomous. The fourth factor, PATENT, includes the two items on how university discoveries should be handled. The remaining two items dealing with curtailing consulting and the need for more public support to develop new uses for agricultural commodities were dropped from the analyses because they did not clearly load on any one factor.

Of the remaining nine items, four factors were isolated, a rather disappointing finding given that three of the factors contained only two items each. The alpha reliability coefficients did nothing to allay our disappointment. The alpha coefficients of reliability for the LINK scale was a modest .68. The reliability coefficients for the PAY scale was .44, for the AUTON scale .39, and for PATENT .64. Thus the scales did not meet the test of reliability suggesting more refinement is necessary. At this point it would have been easy to cast the data aside (some would suggest wise). However, we decided to complete the planned analyses, proceeding as if the factor analysis had produced reliable scales on university-industry linkages to test if any of the predicted relationships were present.

Bivariate Analysis

The zero order correlation coefficients presented in Table 6 provide mixed support for the predicted relationships. Apparently the level of economic hardship of farmers is not related to support for university-industry linkages as operationalized by the four scales. None of the 12 relationships were statistically significant. The perceived or projected quality of life changes, concern about one's farm financial condition or debt-asset ratio were not

related to the four scales. This preliminary finding suggests one must reject the hypothesis that financial distress would be related to support for university-industry linkage.

Data in Table 6 provides support for the prediction that scientific orientations would be positively related to university-industry linkages. Moderate to strong relationships are found between the three scientific orientation scales and the linkage scale. Moderate to weak relationships exist between the scientific orientation scales and the PAY and AUTON scales. The PATENT scale was not related to the science orientation indicators.

Support for economic development was positively related to the LINK scale, providing modest support for the prediction that farmers most supportive of economic development would also support university-industry linkages. The remaining three scales (PAY, AUTON, and PATENT) were not related to economic development.

Socio-economic status of the respondents was related to the "PAY" scale. Older farmers, with few years of education, with low incomes, and farming smaller farms, were more likely to agree that research priorities are determined by who can pay and that scientists are more interested in helping private industry.

Respondent's socio-economic status was not related to support for university-industry linkages as measured by the LINK, AUTON or PATENT scales. Of the 15 relationships, only 3 were statistically significant.

Summary

This exploratory analysis is an attempt to examine if the farm crisis will have lasting effects on how farmers view land grant colleges and industry linkages. Much of the activity surrounding the rebuilding of the state's weakened economy rests upon university-industry linkages. We predicted that

support for these linkages would be dependent upon 1) the level of economic hardship experienced by respondents; 2) their general orientation or "faith" in science; 3) their level of support for economic development and diversification; and 4) socio-economic status.

The best predictor of support for university-industry linkage appears to be farmers' faith in science and their commitment for economic development. Level of economic hardship and socio-economic status were not related to the linkage scales.

However, several problems with this analysis were encountered, which should be noted. Unfortunately, the 11 attitudinal items factored into 4 scales. The reliability coefficients are low, in part, because of the limited number of items in each factor. A second problem with the LINK scale is the lack of variability. The skewness of responses (nearly three-fourths favor more university-industry linkage) provides little variation to be explained. Beyond the methodological limitations of the measures, and the adequacy of the data, there appears to be reason to re-think the complexity in addressing university-industry linkages.

One plausible explanation is that university-industry collaboration is not yet a salient public issue. Therefore, opinions on levels of support for these mutual activities are not well thought through. It may be that as more public discussion occurs on the benefits and consequences of university-industry linkages, a more informed public opinion will emerge.

We readily acknowledge the need for better measurement of public opinions on university-industry linkage and replication in other settings. However, the nagging question remains, if university-private sector linkages are being aggressively sought and encouraged, without the benefit of public dialogue, then questions of long-term support for mutual ventures must be raised. Throughout

the first century of the Hatch Act, there has not been a clear public decision on how much collaboration is desirable. As others have noted the relationship between publically supported universities and the private sector has been hotly contested but we question whether the issue has ever become a salient public issue. We conclude that although farmers are generally supportive of university-industry linkages, it is too early to accurately predict whether support will be sustained in the future. The level of support that currently exists may increase as farmers benefits from the agro-high tech promises. On the other hand, support for university-industry linkages may decline if farmers perceive they are not the primary beneficiaries.

Table 1. Farmers opinions about university-industry linkages

	Strongly Agree	Somewhat Agree	Uncertain	Somewhat Disagree	Strongly Disagree
	- - - - - Percent- - - - - -				
Iowa State University should work more closely with private business and industry, including agricultural producers (Link)	27	49	14	7	3
Closer linkages between university scientists and industry need to be encouraged (Link)	19	51	19	8	3
The insights and resources of industry can help improve the quality and value of university research (Link)	16	59	21	3	1
Scientific research today is determined more by who can pay than by what is needed by society (Pay)	30	48	14	6	2
University scientists are often more interested in helping private industries than in serving the state's citizens (Pay)	17	33	32	15	3
Scientists, rather than the agribusiness community, should determine what types of problems need to be investigated (Auton)	6	17	22	38	18
Scientists should select their research problems on the basis of scientific criteria rather than whether or not this research will benefit economic development in the state (Auton)	4	18	29	37	12
New discoveries by university scientists should be patented by the university and sold to the highest bidder who would then make these products commercially available (Patent)	12	27	27	20	14
New discoveries by university scientists should be available without restriction to any companies that wish to market these products (Patent)	12	28	23	27	10
The amount of private consulting of university scientists should be curtailed	5	20	44	25	6
More public funds should be used to support the development of new uses for agricultural commodities	30	45	16	6	3

Table 2. Distributions and Descriptions of Economic Hardship Indicators

	Become Much Better	Become Somewhat Better	Remained The Same	Become Somewhat Worse	Become Much Worse
			- Percent-		
Economic Hardship					
During the past 5 years, has the quality of life for your family (X1154)	3	16	40	33	8
In the next 5 years, will the quality of life for your family (X1156)	3	21	45	26	6

Index of X1154 and X1156
Alpha = .64

Score	Percent
2 - 4	13
5 - 6	46
7 - 8	34
9 -10	8

		Percent
How concerned are you about your farm's financial condition? (X1128)	1. Not concerned	18
	2. Slightly concerned	20
	3. Moderately concerned	22
	4. Very concerned	38

Debt-asset ratio
Range 0-100, mean .32, standard deviation .36, median = .23

Table 3. Distributions and Description of Science Orientation Scales*

	Strongly Agree	Somewhat Agree	Uncertain	Somewhat Disagree	Strongly Disagree
	- - - - - Percent- - - - - -				
The need is greater then ever for vigorous agricultural research programs at agricultural colleges and universities (X542)	31	43	15	9	3
The need for the College of Agriculture is becoming more important than ever (X551)	26	47	19	6	2
We should encourage enrollments to increase in the College of Agriculture (X552)	20	44	27	7	2
Extension should be providing educational materials to both farm and nonfarm people (X553)	30	53	12	4	2
FACTOR - GREATER NEED, ALPHA - .77					
Research by private agribusiness firms can never replace the need for university experiment stations (X543)	30	41	15	12	3
Research at agricultural colleges is years ahead of private industry (X544)	4	26	45	24	6
Creative ideas more often come from the university than from private corporations (X546)	6	27	37	24	6
FACTOR - CREATIVE RESEARCH, ALPHA - .65					
Extension programs have been very beneficial to my family (X545)	13	46	21	16	4
Most of the Cooperative Extension Service's programs complement rather than compete with private firms (X549)	15	51	29	5	1
Extension has responded to the needs of rural America (X550)	11	59	19	9	2
FACTOR - NEED EXTENSION, ALPHA - .60					

*These items were coded "1" - strongly disagree to "5" - strongly agree.

Table 4. Distributions and Description of Economic Development Indicators

	Strongly Support	Somewhat Support	Uncertain	Somewhat Oppose	Strongly Oppose
	- - - - -		Percent-	- - - - -	
Economic Development Strategies					
Attract high technology industries (X711)	35	48	10	4	2
Emphase more manufacturing jobs in nonagricultural industries (X713)	36	51	9	3	1
Provide tax incentives to companies to locate in the state (X721)	23	47	18	9	3
Focus on retention and expansion of existing industries (X722)	47	47	6	1	0
FACTOR - ECONOMIC DEVELOPMENT, ALPHA .71					

Table 5. Distributions and Description of Socio-Economic Variables

Age (X1346)	Range 22-86; mean=53.7; standard deviation=11.6	
Education (X1347)	Range 1-21; mean=12.5; standard deviation=2.5	
Total acres operated	Range 8-5,376; mean=417; standard deviation=386	
Gross farm sales (X1343)		Percent
	1. Less than $2,500	3
	2. $2,500-$9,999	7
	3. $10,000-$19,999	7
	4. $20,000-$39,999	16
	5. $40,000-$59,999	13
	6. $60,000-$79,999	9
	7. $80,000-$100,000	8
	8. $100,000-$199,999	22
	9. $200,000 or more	14
Income (X1344)		Percent
	1. Les than $2,500	2
	2. $2,500-$9,999	14
	3. $10,000-$19,999	27
	4. $20,000-$34,999	28
	5. $35,000-$49,999	15
	6. $50,000-$74,999	10
	7. $75,000 or more	4

Table 6. Correlations between University-Industry Linkages, Economic Hardship, Scientific Orientations, and Economic Development Scales

	Link	Pay	Auton	Patent
Economic Hardship				
Quality of Life	-.03 NS	.05 NS	-.03 NS	.06 NS
Concern	.04 NS	.01 NS	-.04 NS	.05 NS
D/A ratio	.01 NS	-.01 NS	.01 NS	.01 NS
Science Orientation				
Greater Need	.28**	-.14**	-.01 NS	-.02NS
Creative Research	.12**	-.13**	.17**	-.04 NS
Need Extension	.16**	-.19**	.05NS	.05 NS
Economic Development	.23**	-.01 NS	.04 NS	.07*
Socio-Economic Traits				
Age (X1346)	.01 NS	.13**	.01 NS	.09*
Education (X1347)	.03 NS	-.11**	.04 NS	-.04 NS
Income (X1344)	.04 NS	-.08*	.03 NS	.03 NS
Gross Farm Sales (X1343)	.11*	-.11**	-.01 NS	.04 NS
Total Acres Operated	.01 NS	-.01 NS	.03 NS	.06NS

** $p < .01$

* $p < .05$

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