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Economic Impacts and Program Involvement in Agricultural Mechanics Competition Projects in Texas

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Abstract

Supervised Agricultural Experience (SAE) is a well-documented, valuable, and integral part of agricultural education programs (Bryant, 2003; Cheek, Arrington, Carter, & Randall, 1994; Deyoe, 1953; Dyer & Osborne, 1996; Moore, 1988; Roberts & Harlin, 2007). Cole and Connell (1993) found that there was little research regarding the economic value of SAEs; they suggested that measuring the cost and economic benefits of SAEs would provide valuable information in communicating additional benefits of SAE programs. Hanagriff, Murphy, Roberts, Briers, & Lindner (2010) suggested economic values are best derived from measuring spending and that research should be undertaken to understand the economic value of educational programs, especially in high cost areas such as agricultural mechanics. This study found that 45% of agricultural education program are involved in agricultural mechanics show projects, which potentially relates to $5.5 million in direct spending and $10 million in economic impacts. Additionally, programs with agricultural mechanics show projects recognize greater participation in agricultural mechanic SAEs, are more active in using record books, are larger in program size, and recognize greater financial support.

Keywords: Agricultural economic value, agricultural mechanics, agricultural laboratory, program assessment

Previous research has linked the educational value of Supervised Agricultural Experiences (SAEs) to student achievement and knowledge (Cheek, Arrington, Carter, & Randall, 1994; Dyer & Osborne, 1996). The educational purpose and objectives built into SAEs supports students by challenging them to gain new skills and experiences (Bryant, 2003). However, SAEs requires additional investment costs such as travel and supplies, which usually are funded outside of the educational system. An additional experiential learning activity, with similar objectives to SAE is laboratory instruction. According to Shinn (1987), approximately two-thirds of instructional time in agricultural education programs is devoted to laboratory instruction. Similar to SAEs, laboratory instruction is a high-cost investment area, including the cost of consumable supplies and capital equipment. Agricultural mechanic show projects are very likely related to either laboratory instruction for an entire course or to a select group of students as an SAE, or even included in both areas of instruction. As educational funding

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becomes restricted and reallocated, both SAEs and laboratory instruction in agricultural mechanics are at risk of being reduced or eliminated. Policy makers making these decisions are likely not familiar with the total program and community values related to these educational resources.

This issue is related to the American Association for Agricultural Education's research priority 1 for 2011-2015, which involves informing decision makers that likely have little or no understanding of the complexities involved in sustaining viable agriculture systems (Doerfert, 2011). The viable decision factor for agricultural mechanic show projects is to not only focus on the educational value, but also the economic value of programs engaged in this area of instruction, which relate to value in a local community.

This study examines the economic value of agricultural mechanic show projects and examines previously completed research in economic valuation of programs to potentially develop an economic valuation process in this educational area. These results are potentially informative to local programs, communities and policy makers.

Review of Literature

The educational value of experiential learning is well established in literature (Bryant, 2003; Cheek, Arrington, Carter, & Randall, 1994; Deyoe, 1953; Dyer & Osborne, 1996; Kolb, 1984; Moore, 1988; Roberts & Harlin, 2007). Experiential learning has been an integral component of agricultural education since passage of the Smith-Hughes Act in 1917. This act required that supervised farm projects be an integral part of all agricultural education programs (Deyoe, 1953; Moore, 1988, 2003). Understanding of these supervised experiences was broadened and modernized in 1988 when The Committee on Agricultural Education in Secondary Schools released a report recommending that "emphasis should be placed on the experience and entrepreneurship, not only on the occupation" (Moore, 1988, p. 41).

The educational value of supervised experiences has been well documented in agricultural education literature (Roberts & Harlin, 2007). Over time, "the purposes of projects in agricultural education have expanded beyond skill acquisition and proficiency to include personal development for diverse career preparation beyond agriculture" (Roberts & Harlin, 2007, p. 53). Although many types of supervised experiences are now embraced, those that focus on entrepreneurship have long been central to agricultural education.

Newcomb, McCracken, Warmbrod, and Whittington (2004) reported that SAEs allow students to apply practices and principles learned in the classroom and to develop new skills and abilities through involvement in SAEs. Further, the authors concluded that supervised experiences also improve learning, student personal development, and occupational development. Case and Stewart (1985) indicated that students with both ownership and placement SAE projects came from schools with stronger programs. In other words, strong SAE student involvement is linked to strong agricultural education programs.

Extensive evidence of the educational value of the SAE exists in the literature, but the value of SAEs from an economic standpoint is not as well documented. In 1985, the Western Region of the American Association for Agricultural Education recognized the importance of this question by including the economic assessment of SAEs among their regional research emphasis areas. Eight years later, Cole and Connell (1993) reported that studies had been completed in the Western Region on leadership and advancement of educational progress, but none were related to economic assessment.

Several approaches to determining the economic value of SAEs have been reported in the literature. Cole and Connell (1993) completed a study measuring the economic impact of Oregon agricultural science and technology programs by examining teacher salaries (program value). They found that the average annual agricultural program economic value was $143,763. They recommended conducting additional research using cost/benefit analysis to measure the economic value of programs. Christiansen (1999) reported that assessing economic value of SAEs was timely given the current climate of depressed times and lower funding. West and Iverson (1999) evaluated 174 agricultural education programs and determined that the local economic impact of SAEs per program in Georgia was $71,344, with a total value to the state of $12 million.

In Missouri, Graham and Birkenholz (1999) used SAE labor (placement) income to calculate program value. Retallick and Martin (2005) used similar indicators in an eleven-year study (1991–2001) to identify the economic impact of placement SAEs in Iowa. Most recently, Hanagriff, Murphy, Roberts, Briers and Lindner (2010) estimated agricultural programmatic value in Texas by measuring SAE and related travel at $93,222 and $12,654 respectively. They also utilized the IMPLAN (Impact Analysis for Planning) economic model of assessment and determined $105,877 per Texas program in total economic value and recommended greater efforts in studying the economic value.

Conceptual Framework

The framework for this study follows the recommendations of Hanagriff et al. (2010) by focusing on spending values and applying the focus to the area of agricultural mechanics type projects, uses of record books and the recognition of this area as an SAE. Hanagriff et al. (2010) also inferred economic value from a widely used method called Impact Analysis for Planning (IMPLAN), which serves as the conceptual frame for measuring economic values. The IMPLAN input-output database and modeling system produces multiplier values from economic models to estimate the economic impacts of spending on a region's economy and is relevant as a valuation tool for educational programs (Alward, 2008; Arik and Nsiah, 2004; Blackwell, Cobb, and Weinberg, 2002; Mulkey & Hodges, 2003; Norton, 2004).

Purpose and Objectives

The purpose of this study was to measure the economic value of agricultural mechanics projects and how those values relate to agricultural mechanic show projects. The specific objectives of the study were to: (1) compare demographic program characteristics, (2) examine relationships between agricultural mechanics show projects, SAEs and other related program variables, (3) determine agricultural educations program involvement in specific agricultural mechanics show projects and the average investment cost per type, (4) estimate investment costs for agricultural mechanics projects in Texas, and (5) estimate the total economic impact of agricultural mechanics projects on the Texas economy.

Methods

The survey instrument for this study utilized validated instrument and procedures outlined by Hanagriff et al. (2010). This instrument also included categories of show projects developed from Texas entry forms used in agricultural mechanic contest. These categories include cost values and involvement in agricultural machinery and equipment, electrical, livestock equipment, trailer equipment, tractor restoration, BBQ pit, and wood show (competition) projects. The validity of the added questions and categories of show projects were reviewed and edited by the competition managers for the three largest agricultural mechanic projects shows in Texas. A final survey instrument was developed in March and disseminated to teachers beginning in May with follow-up procedures through August. Survey instrumentation utilized Survey Monkey and followed the current Texas Educational Agency's email distribution lists.

Utilizing the instrument from Hanagriff et al. (2010), respondents were asked to reply to questions regarding demographics, years of teaching experience, location in the state, student enrollment in the agricultural education program, student membership in the FFA, involvement in agricultural mechanic SAEs and involvement in agricultural mechanics show projects. Additionally, teachers described each their students' agricultural mechanic show projects with: (a) an estimate of the average expense for one unit for each enterprise, (b) the total number of enterprises in their chapter during a 12–month period, and (c) the total number of students in the chapter who had each project type. As in the Hanagriff et al. (2010) study, this study requested teachers review student record books and interact with students to develop cost, frequency and involvement values for each area of agricultural mechanics show projects.

The sampling frame was a census from the population of Texas teachers listed in the state agricultural science teacher's directory. In March, emails were sent to 1,426 teachers representing 975 FFA chapters. Only one response was requested per chapter, and the chapter FFA number was used as a control value. The initial survey request was sent in May with two reminder emails in June and July resulted in 460 teachers completing the survey.

In addressing non-response error, and its threat to validity, the researchers followed method 1 outlined by Lindner, Murphy, and Briers (2001). They recommended that if late respondents did not differ from early respondents, results could be extrapolated to the population. In August, a series of late follow–up emails was sent, with 31 additional teachers responding. These were identified as late respondents, and used as a comparison group to the 460 early respondents. No statistically significant differences existed (α set at .05) between early and late respondents for any demographic variables, involvement in SAEs, agricultural mechanic show projects and reported cost values. To develop the entire sample, the late respondents of 31 were added to the 460 initial respondents for 491 usable teacher responses. This represents 50% of the agricultural education programs and FFA chapters in Texas.

Economic values are represented by teachers estimated values required to complete an agricultural mechanics SAE or show projects. These values were then totaled and multiplied to the production agriculture IMPLAN economic impact value ($1.80) to determine economic impact to Texas. The IMPLAN model for estimating additional values beyond direct spending is an input–output model used to measure economic value of particular industry related financial transactions for a particular region. According to Mulkey and Hodges (2003), policymakers, industry officials, and others often need information on the total economic impacts of specific local economic sectors or on the impacts of various changes in the local economy. These values can be determined using the IMPLAN model. In this study, the related IMPLAN values used were $1.80 for agriculture and $2.09 for travel cost in Texas. These would indicate that additional spending of $1.00 in the agriculture industry or travel industry would result in a total change in local output of $1.80 for agriculture and $2.09 for travel related values in Texas.

Descriptive statistics were primarily utilized to describe results, and potential relationships measured utilizing Pearson Product Moment Correlations. Magnitude of the correlations was interpreted using the Davis Conventions (1971).

Results

Texas Education Agency data illustrates that 90% of agricultural education programs offer agricultural mechanics courses each year. Texas Education Agency also reports school enrollment included 99,281 students in agricultural education, an average of 101 students in each of the 975 programs. Nearly half of the responding programs (225 of the 491 programs or 45%) were involved in agricultural mechanics show projects.

Considering all respondents, Texas agricultural education programs had an average of two teachers and responding teachers reported an average of 14 years of professional experience. Programs also reported an average of 13,829 annual travel miles and 48 hotel rooms, which were reported as used for all events, such as agricultural competitions, FFA events and other program events. Nearly half of the responding programs (225 of the 491 programs or 45%) were involved in agricultural mechanics show projects.

Programs (through the teacher or teachers together) also reported a perceived Likert type scale value of financial support from their school, booster club, and community. The reporting Likert type scale used (1) no support available, (2) no support given, (3) low support, (4) average support and (5) high support. The most frequent response regarding financial support was an average level of support (4) for support from the school (216 programs), administration (223 programs) and community (259 programs). The most frequent reporting for booster club was a high-level of support (5), which represented 199 programs.

Objective one focused on comparing demographic characteristics, which included describing programs with agricultural mechanic projects compared to non-participating programs. Programs reporting involvement in agricultural mechanic show projects illustrated higher mean values across all areas, which include numbers of teachers, agricultural education students, students in FFA students maintaining record books, financial support, and community support.

These values are descriptive, but provide insight into differences in agricultural mechanic show project programs and those reporting no participation in this area. Descriptive results identified that responding programs with agricultural show projects have greater numbers of teachers, agricultural mechanic SAE projects, agricultural educational enrollment, FFA membership and more frequently report higher levels of community support. Table 1 provides a summary of descriptive results by reporting mean values along with corresponding standard deviation.

Table 1

A comparison of demographic variables in programs with and without agricultural mechanics projects

	Show Projects			No show Projects		
Program variable	*n*	*M*	*SD*	*n*	*M*	*SD*
Number of Teachers	170	2.01	.94	210	1.69	.84
Ag Mechanic SAE Projects	127	14.07	16.10	73	7.84	14.06
Student Ag Enrollment	172	171.10	124.33	210	141.78	106.64
FFA Membership	172	89.13	65.26	210	71.91	52.63
Percent Use of Record Books	169	39.25	38.13	208	38.15	38.36
Overall financial support	171	4.02	.74	210	3.92	.78
Community support	171	4.23	.70	209	4.08	.75

Note: Responding numbers may differ due to missing responses.

Objective two was to determine if agricultural educational program demographics are potentially related to involvement in agricultural mechanic show projects. Involvement in agricultural mechanics show projects was measured from respondents reporting the number of competitions and projects they exhibited. Pearson correlations were used to determine relationships between involvement and program demographic variables. The findings are reported in Table 2.

Table 2

Program Demographics Correlated to Involvement in Agricultural Mechanic Show Projects

Demographic Area	*n*	*r*
Agricultural Mechanic SAEs	329	.44
Number of Teachers	380	.20
FFA Membership	382	.18
Student Ag Enrollment	382	.14

Note: Davis (1971) convention reports relationships and relative association value of .01-.09 negligible, .10-.29 low, .30-.49 moderate, .50-.69 substantial, over .70 very strong association.

In Table 2, the Davis (1971) convention was used to interpret the magnitude of each correlation, which may also serve as a measurement of effect size. A moderate positive correlation was found between chapters reporting involvement in agricultural mechanic show projects and those reporting involvement in agricultural mechanic SAEs. Low positive correlations were found between agricultural mechanics SAE investment and the number of teachers, the number of FFA members in the program, and the number of agricultural education students in the program.

Objective three was to measure the cost of agricultural mechanics show projects and involvement per program. Respondents were asked to include only the value of materials and supplies needed to complete the project. This excludes capital costs (e.g., welders or other equipment and tools) and labor needed for project development or construction, since these cost would extend beyond annualized values.

Agricultural education programs were most likely to report that their students participated in machinery and equipment projects, with 115 of the 225 programs reporting projects in that area. Project areas illustrating less participation include BBQ pits (*N =79)*, livestock equipment (*N* = 76), trailers (*N* = 69), wood (*N =64)*, tractor restoration (*N* =20), and electrical (*N* =11). Student's may have been engaged in multiple projects, but the focus of these findings is just if programs are involved in certain areas of competition projects. A complete list of chapters' involvement in agricultural mechanics show projects and the mean values of associated cost are illustrated in table 3.

Table 3
Average Annual Investment Cost per Agricultural Mechanics Project

Project Area	Chapters reporting (N)	%	Mean Reported Investment Cost (MRIC)	SD
Machinery & Equipment	115	51%	$1,136	$1,555
Electrical	11	5%	$573	$820
Livestock Equipment	76	34%	$587	$945
Trailer	69	31%	$2,493	$2,392
Tractor Restoration	20	9%	$4,708	$2,691
BBQ Pit	79	35%	$536	$702
Wood	64	28%	$258	$434

The mean reported investment cost (MRIC) is calculated from the costs reported by programs. Tractor restoration and trailer construction projects had the highest reported investment cost, but represented fewer chapters involvement in these projects.

Objective four was to calculate the investment cost for each area and develop total state value. To develop program value, there is a need to measure the numbers of projects within the program that are agricultural mechanic show projects. Table 3 reported the number of programs involved in projects, but more applicable to economic value is the number of projects per program.

Table 4 summarizes reported frequency of projects as well as calculates the average number of projects for programs reporting involvement in this sample (n = 225). Lower involvement or numbers of projects are of course related to higher cost projects. Table 4 illustrates total reported agricultural mechanic projects and the mean number of projects per reporting program.

Table 4
Frequency of Projects and Average Program Involvement

Project Area	Frequency of Projects *(f)*	%	Average Projects per Program *(m)*
Machinery & Equipment	1,096	30%	4.87
Electrical	47	1%	0.21
Livestock Equipment	648	18%	2.88
Trailer	175	5%	0.78
Tractor Restoration	29	1%	0.13
BBQ Pit	698	19%	3.10
Wood	950	26%	4.22

Agricultural education programs reported greater student involvement projects in the areas of machinery and equipment (m = 4.87), wood (m = 4.22), BBQ Pit (m = 3.10) and livestock equipment (m = 2.88), with less program involvement in remaining areas.

The average number of projects and their average costs were used to develop a total cost for each project area across all reporting programs. Table 5 summarizes the number of projects in each area; value invested in each area and estimated spending for all programs in Texas.

As illustrated in Table 5, the highest program involvement project was machinery and equipment, which also had the greatest total investment value to Texas, with $2.4 million in estimated total spending.

Table 5

Frequency of Projects and Total Estimated Investment Cost Using Average Cost

Project Area	Projects per Program *(M)*	Mean Reported Investment Cost (MRIC)	Mean Program Investment Cost *(M)*[1]	Total Estimated Texas Investment Cost [2]
Machinery & Equipment	4.87	$1,136	$5,532	$2,428,548
Electrical	0.21	$573	$120	$52,680
Livestock Equipment	2.88	$587	$1,691	$742,349
Trailer	0.78	$2,493	$1,945	$853,855
Tractor Restoration	0.13	$4,708	$612	$268,668
BBQ Pit	3.10	$536	$1,662	$729,618
Wood	4.22	$258	$1,089	$478,071
			Total	$5,553,789

Note. [1]Program investment cost is found by multiplying reported projects per program by the mean reported investment cost. [2] Total estimated spending is found by multiplying the program investment cost per project area by the estimated 439 programs participating in agricultural mechanics projects.

A previously reported low involvement project area was trailer projects, but due to the higher investment cost, the total investment value reaches $853,855 and brings values similar to more frequent projects.

The total of all project areas represents over $5.5 million in direct investment for the 439 programs in Texas. Of the 439 programs estimated to be involved in agricultural mechanics projects, the average program spent $12,651 related to agricultural mechanic projects. However, this represents only programs that reported involvement in agricultural mechanic show projects and likely does not include additional agricultural mechanic SAEs, which is most likely additional values not reported in this process.

Objective five was to estimate total economic impact from agricultural mechanics SAE projects. As previously outlined by Norton (2004), economic impact can be determined by using expenditure costs and applying the IMPLAN multiplier value to estimate total economic impact, which can be a valuable tool to policy makers. As previously mentioned, the reported spending of all programs in Texas on agricultural mechanics programs was estimated at $5.5 million, but economic value represents values beyond direct spending. Economic value of spending represents additional ripple effects in the Texas economy, which are the values that extend beyond the direct cost associated to producing these projects. Using the $5.5 million in estimated total direct spending, the economic impact of this spending was estimated to be nearly $10 million ($5.5M * 1.80 IMPLAN Type II Value), which represents additional effects such as business sales of supplies causing employment, which encourages spending and cycles through the economy.

Conclusions

As recommended by Cole and Connell (1993), a cost/benefit analysis offers an economic assessment approach and the methods to these conclusions follow their recommendation. Programs that reported involvement in agricultural mechanics project construction illustrated a moderate relationship to involvement in agricultural mechanic SAEs, and low positive correlations to greater numbers of teachers, agriculture enrollment, and FFA membership. These relationships may also be necessary variables for any program to have in order to support laboratory instruction.

The positive relationship between agricultural mechanic show projects and chapters reporting similar type of SAEs is expected, but a question still remains on how show projects are being shared among students as an SAE? The low, but positive correlation to greater program size (Student numbers and numbers teachers) potentially describes that programs engaged in this type of activity are larger programs that tend to have greater equipment and facility resources.

This research also illustrates that programs engaged in agricultural mechanic show project are likely higher in involvement in similar SAEs, which according to Case and Stewart (1985) also are an indication of stronger agricultural education programs. There are easily measured economic values, but potentially higher educational value.

In conclusion to the types of projects and chapter's involvement, tractor restoration and trailer construction projects required the greatest financial investment per project. Machinery and equipment was the most frequent project and third highest investment area, but easily generated the greatest total economic impact to the Texas economy. The big projects certainly grab attention, but the bulk of the participation, and economic impact, can be found in the other project areas.

In terms of total estimated value, findings indicate that agricultural mechanics projects contributed $5.5 million in total investment costs, and nearly $10 million in economic impact, to the state's economy. These values were driven by the 45% of programs indicating participation in agricultural mechanics project construction. Obviously, greater involvement would increase the total economic value to the Texas economy. Chapters involved in agricultural mechanic show projects are likely involved in similar type SAEs, but it is not clear if their associated economic values are included in these reported show type projects, which may provide additional economic values not captured within this study.

This study utilized methods and the assessment model suggested by Hanagriff et al. (2010), but added identifying the economic value for laboratory use for agricultural mechanic show projects. While the primary value of agricultural education in the secondary schools has been and will remain the acquisition of knowledge and skill and the development of young people of high character, the positive economic impact of these programs on the local and state economies in which they participate contributes an additional assessment of their value. Economic assessment is needed and is most important in difficult economic times when potential funding of laboratory support may decline. Removing funding for laboratory support that initiates and creates agricultural mechanic show projects will likely reduce student involvement and have a negative impact on state and local economies. If these impacts are communicated to stakeholders, this may deter budget cuts that relate to laboratory facilities or numbers of teachers, since there is a noted economic return.

Recommendations

Current economic conditions closely match those outlined by Christiansen (1999), making this assessment of economic values derived from an educational activity timely and valuable to policy makers and stakeholders. These groups are likely struggling to maintain and seek new funding to support laboratories used in agricultural education, and this research potentially offers valuable information to support that effort. Additional research is needed to measure the economic value of agricultural education programs, including SAEs of all types. Relationships between economic value generated and other programmatic variables, such as student involvement, retention, graduation rate, outcome test scores, etc., should be identified and described as economic support for education maybe related to program quality. More narrowly defined project areas by level of cost, or type of projects within an area, may be beneficial in assessment.

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