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SELECTED ECONOMIC IMPLICATIONS OF ALTERNATIVE DEVELOPMENT STRATEGIES  
FOR THE NAVAJO INDIAN IRRIGATION PROJECT\*/

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The purpose of this paper is to focus on selected economic implications of alternative development strategies for the Navajo Indian Irrigation Project as reported in a recently published report [1]. The specific objectives of this study were to identify the economic potential of selected crops and livestock and to specify and evaluate alternative farm organizational structures in terms of investment and operating capital requirements, income and employment created, and education, training, and skills required. This study was conducted in cooperation with the Navajo Tribe, Four Corners Regional Commission, Bureau of Indian Affairs, and the Bureau of Reclamation.

The Navajo Indian Irrigation Project is a 110,630-acre irrigation development in north-west New Mexico. Congress has authorized \$206 million for the irrigation project and has appropriated \$47 million to date. Construction began in 1964. Water for the first 10,000 acres is expected by 1975, and thereafter an additional 10,000 acres will be irrigated annually until the project is completed.

The Navajo Reservation encompasses 16.5 million acres in Arizona, New Mexico, and Utah and is home for 134,000 people. The population is increase at 2.5 times the national average rate, and 2,000 additional Navajos enter the labor market yearly. A 1967 survey revealed that over 60 percent of the reservation's labor force of 32,350 was "nonemployed" [5]. Per-capita personal income on the reservation in 1967 was \$825; the national per-capita personal income was \$3,098 [6, 7].

Past irrigation projects to aid Navajos were established on a family farm basis. The Hogback and Fruitland projects were established in the 1930's as subsistence farms averaging 10 acres [8]. Many of these now are homesites and are no longer used for irrigated agriculture.

The Hogback Project was extended in the 1950's to create 11 farm units ranging in size from 105 to 140 acres. The 11 assignees were assisted by the tribe with training and capital loans. Only one of the original assignees has operated his farm every year.

The Colorado River Indian Irrigation Project located near Parker, Arizona, was organized in the 1950's. Farms of 160 acres were assigned to 149 Navajo families who migrated from the reservation. Presently, 53 Navajo families remain, but none is engaged in farming. Most of the land has been leased to non-Indian farming corporations [9].

Previous irrigation projects have had limited success in establishing commercial irrigated farming as an income and employment base for Navajos. Reasons frequently given for the low success rate are (1) insufficient farm management training, (2) lack of farming experience, (3) improper supervision, (4) lack of interest in farming, (5) units that are too small for commercial farming, (6) lack of supporting farm supply and marketing institutions, and (7) capital limitations.

#### Project Objectives

Most government-sponsored irrigation projects in the United States have been developed, by law, as family farms. However, the law does not specify that the Navajo Indian Irrigation Project must be developed this way. Other farm organizational structures can and should be considered because of the Navajo culture, income and employment needs, farming experience, and lack of social capital development. Among alternative organizational structures are (1) a tribal farm, (2) family farms, (3) leases to farming companies, and (4) combinations of the above alternatives.

Economic objectives suggest selecting the organizational alternative that would (1) maximize employment and income, including secondary and tertiary impacts on and off the reservation, (2) maximize return on invested capital, and (3) operate with "reasonable" risk levels. Social objectives suggest selecting the organizational structure that would (1) maximize individual development, (2) contribute most to elimination of social problems on the reservations, and (3) contribute most to the overall welfare of the tribe. Many of these objectives are difficult to quantify, are conflicting, and thereby create a need to

measure and evaluate economic and social "tradeoffs".

Many people think that owning and operating a business is superior to salaried employment. Development of the project as family farms would create this opportunity. Development as a tribal farm would create opportunities for salaried positions. What are the economic tradeoffs and social implications for the Navajos between (1) opportunities for income and employment through individual business and (2) opportunities for income and employment through salaried positions? Tradeoffs may be evaluated through estimates of total employment created, labor income generated, and return to capital invested for the project developed as family farms or a tribal farm.

#### Description of Organizational Alternatives

The tribe may wish to coordinate all irrigation project activities through a tribal farm operating company. The operating company would be controlled by a board of directors who would hire a general manager to coordinate all business and service activities (Figure 1). An alternative would be family farms and independent service and supply businesses operating under general policies of a board appointed by the tribe (Figure 1).

A basic difference between family farm and tribal farm development would be the number of decision units. Individual farms would make independent decisions on crops to produce, sources of farm supplies, and time and method of product marketing. To facilitate coordination between supply, production, processing, and marketing, the tribe could organize and operate some or all of these industries. Non-tribal operated firms (Navajo or non-Navajo) might also provide these services. A third alternative would be for farmers to form co-operatives.

#### Research Approach and Assumptions

Budgets for crop, livestock, and industry activities were developed for 320-acre farms and for a tribal farm [1, 2, 3]. Linear programming was used to determine the optimum combination of activities. A total of 21 crop and 3 livestock activities were budgeted for family farms, and 22 crop and 7 livestock activities were budgeted for the tribal farm. Only crop and livestock activities showed evidence of being profitable were included as programming activities. Assumptions were made to allow for an orderly "phase-in" of crop and livestock activities as the project expands from 10,000 to 110,630 acres. Constraints on (1) amount of resources used in any one activity, (2) market impact, (3) land, and (4) water were imposed on the optimization program. Also, various levels of constraints were imposed on capital and labor use. Estimates of investment and operating capital requirements, employment created, and income potential were obtained from the optimum crop, livestock, and industry combinations.

#### Results

No Constraints on Capital and Labor: Objective Function Maximizes Total Profits.

The tribal farm was found to require \$56.5 million investment capital and \$43.6 million operating capital (Table 1). This compared to \$50.4 million and \$32.3 million, respectively, for the 320-acre family-farm approach. Investment per job created was found to be comparable. Greater investment in livestock facilities was largely responsible for the higher capital requirements on the tribal farm.

The tribal farm created approximately 10 percent more total employment than the family farms. Furthermore, the tribal farm created 224 more employment opportunities (an increase of nearly 50 percent) during the low labor season (Table 1). A larger number employed in livestock industries was responsible for the differences in employment between the family farms and the tribal farm. Approximately 2,500 jobs were created during the peak seasonal employment period with both organizational approaches.

Upon complete project development, the tribal farm would generate \$9.2 million in annual labor income compared to \$6.3 million for the family-farm approach. Annual business operating profits were predicted to amount to \$9.6 million and \$16.2 million for development with family farms and tribal farm, respectively.

Table 1. A Comparison of Investment Capital, Operating Capital, Labor Requirements and Income Generation Between 320-acre Family Operated Farms and a Tribal Farm, for the Fully Developed Navajo Indian Irrigation Project

Item	Individually operated farms (320-acre farm size) (\$1,000)	Tribal enterprise farm (\$1,000)
<u>Investment capital</u>		
Farm investment	25,207	28,120
Agriculturally related businesses	8,920	6,519
Livestock	--	9,183
Infrastructure	16,273	12,667
Total	50,400	56,489
<u>Operating capital</u>		
Direct farm	18,217	15,815
Packing, processing, and custom work	13,338	9,047
Livestock	--	17,554
Infrastructure	737	1,233
Total	32,292	43,649
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(full-time employment equivalents)		
<u>Labor</u>		
Period		
December - March	473	697
April - May	1,285	1,363
June - August	2,532	2,447
September - November	1,368	1,618
Average annual total (weighted)	1,347	1,499
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(\$1,000) (\$1,000)		
<u>Annual income generation</u>		
Labor	6,315	9,186
Business operating profits (including farms)	9,612	16,207

The fully developed tribal farm was predicted to generate, by the end of the twelfth development period, a cumulative total of \$40.9 million expendable net income after interest and principal payments.<sup>4</sup> This income, which would accrue to the tribe, would be approximately \$35 million more total expendable income than derived from family farm development.

#### Capital Constrained

Parametric programming was used to estimate the sensitivity of employment and income generated to various levels of operating and investment capital availability for the tribal farm. Because of the many decision units and business ownership, this analysis was not utilized for family-farm development. Net operating profit and employment were maximized with approximately \$56 million of investment capital and \$44 million of operating capital available. Employment created was slightly more sensitive to constraints on capital availability than net operating profit. Reducing operating capital availability by 37 percent and investment capital by 33 percent, decreased net operating profit by 15 percent and total employment created by 19 percent.

#### Employment Constrained

Substantial changes in employment levels from one season to the next has many disadvantages on the Navajo Reservation since there are few opportunities for additional employment to provide a full annual wage. A social objective function that would retain a fixed number of employees on a year-round basis, possibly receiving full pay for periods worked and one-half pay for the periods not employed, has merit in the present situation.

An analysis was done to estimate the effects on profits of fixed levels of employment created:

<u>Fixed number of full-time jobs</u>	<u>Percent reduction in profit</u>
500	52
1,000	25
1,500	13
2,000	12
2,500	12

The optimum labor force range from 2,000 to 2,500 employees. Below this employment level, many profitable livestock and vegetable crop activities which depressed profits were restricted. Labor utilization ranged from 100 percent during the peak periods to 40 percent during the slack winter period.

#### Conclusions

Economic objectives and sociological considerations reveal several tradeoffs are possible and are directly influenced by the farm organizational alternative selected. The tribal farm offers the greatest flexibility for the achievement of economic objectives consistent with sociological considerations. The potential for income and employment appears to be greater with the tribal farm development.

The location and scope of the project are such that coordinated supply industries and marketing would be required for project effectiveness. The family-farm approach would require these supporting marketing and service systems to be more than subsistence farms.

Capital requirements appear to be similar for both development approaches. Investment capital will require long-term credit. The Navajo Tribe would be in a better position to provide the capital required for the tribal-farm approach. Individual farmers may have difficulty in obtaining the necessary investment capital, since land held in trust by the Federal government cannot be mortgaged.

Interest in family farms persists, but the tribal government appears to favor the flexibility and combination of social and economic benefits possible under the tribal-farm approach.

The Navajo Tribe, through the Navajo Agricultural Products Industry Board (NAPI) has developed a 2,300-acre corporate farm. This farm is serving as a pilot program for the larger irrigation project.

#### FOOTNOTES

\*/ Journal Article 432, N.M. Agr. Exp. Sta.

1/ Presentation to the U.S. House of Representatives Committee on Appropriations Sub-Committee on Interior and related agencies by Wilson C. Skeet, Vice Chairman, Navajo Tribal Council, April 13, 1972.

2/ A tribal farm would be a large farm owned and operated by the tribe, but with a separate board of directors and hired professional management. It could be similar in structure to many large western corporate farms. It might also be compared to the "collective" farms in Israel.

3/ Net income after all business expenses, infrastructure expenses, labor and management payments, interest expenses, and principal repayments are accounted for.

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2. \_\_\_\_\_, Cost and Return Budgets for Selected Crop Enterprises for 320-, 640-, and 1280-Acre Farm Sizes in Northwestern New Mexico, N.M. Agr. Exp. Sta. Res. Rept. 194, March 1971.
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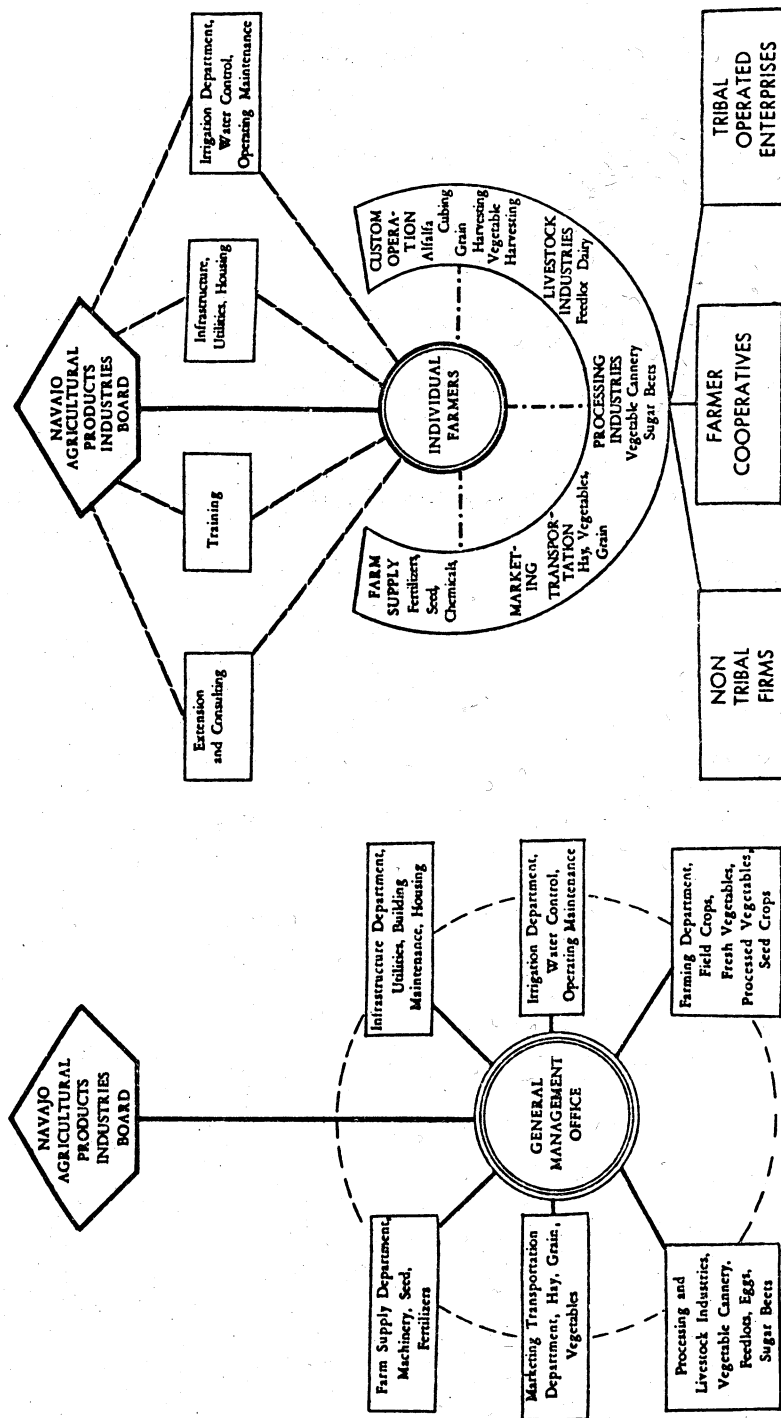


Figure 1. Example Organizational Arrangements for the Navajo Indian Irrigation Project