HB
126

PROPOSED
AMENDMENT

OFFERED IN THE HOUSE: BY: MOSS

TO: SS HOUSE BILL No. 126

SENATE BILL No. ______

PAGE: 1 LINE: ______

Line 11: Delete "Department of Natural Resources" and insert "Department of Commerce and Economic Development for the Alaska Agricultural Action Council"

Line 11: after the word "harvest", insert the words, "and if economically feasible"

Line 12: Insert a period after the word "resources"

Line 15: Delete "Department of Natural Resources" and insert "Department of Commerce and Economic Development, Alaska Agricultural Action Council"

Line 19: Delete "Department of Natural Resources" and insert "Department of Commerce and Economic Development, Alaska Agricultural Action Council"

Line 20: Delete the word "lots" and insert the word "tracts"

Delete the word "area" and insert the words "Agricultural Development Project"

Line 23: After the word "production", add a period, and delete the remainder of the sentence on lines 23 and 24.

Line 26: Delete "Department of Natural Resources" and insert "Department of Commerce and Economic Development, Alaska Agricultural Action Council"

Line 28: Delete the period after the word "facility" and insert the language, "to process livestock produced in the Nenana-Totchaket area"

ENGINEERING ESTIMATE
for CONSTRUCTION of ACCESS ROADS & BRIDGES in the TOTCHAKET AREA

(1983 DOLLARS)

I.	23 Miles of primary access roads constructed to secondary standards by construction contract (single borrow source @ Nenana) 23 Miles @ $519,956.52/mile	$11,959,000
II.	RIGHT-of-WAY ACQUISITION	$30,300
III	NENANA RIVER BRIDGE (440 foot span overall)	$3,800,000
IV	THREE SMALLER BRIDGES across the: Little Nenana River (140 ft span) East Middle River (101 ft span) West Middle River (140 ft span)	$1,900,000
	TOTAL →	$17,689,300

THE LEGISLATURE OF THE STATE OF ALASKA
TWELFTH LEGISLATURE

FISCAL NOTE

I. REQUEST
Bill/Resolution No. Sponsor Substitute for HB 126
Title Special Appropriations for Agricultural Development in Nenana - Totchaket
Requested by Department of Environmental Conservation Date March 1, 1982

II. FISCAL DETAIL
Agency Affected Department of Environmental Conservation
Program Category Affected
BRU, Program, Or Subprogram(s) Affected BRU: EQO (Lab, $348.0) (NRO $92.0)
(Note: If more than one budget component is affected, separate line-item amounts and funding for each component in the analysis section.)

EXPENDITURES (Thousands of Dollars)

	FY 82	FY 83	FY 84	FY 85	FY 86	FY 87
100 PERSONAL SERVICES		3.0	3.0	3.0		
200 TRAVEL		7.8	2.0	2.0		
300 CONTRACTUAL		331.0	34.9	34.9		
400 COMMODITIES		3.5	2.5	2.5		
500 EQUIPMENT		10.0				
600 LAND & STRUCTURES						
GRANTS, CLAIMS, ETC.						
TOTAL		355.3	42.4	42.4		

FUNDING (Thousands of Dollars)

	FY 82	FY 83	FY 84	FY 85	FY 86	FY 87
GENERAL FUND		355.3	42.4	42.4		
FEDERAL FUNDS						
OTHER (Specify Source)						

POSITIONS

	FY 82	FY 83	FY 84	FY 85	FY 86	FY 87
FULL TIME						
PART TIME						
TEMPORARY						

III. ANALYSIS (See Fiscal Note Preparation Instruction, Section III)

Attached

IV. DATE March 1, 1982 PREPARED BY Bill Leitch
AGENCY ADEC
Original: Legislative Finance PHONE 465-2653
cc: Budget and Management
Prime Sponsor (First Legislator Named)
33-001 (Rev. 12/81)

Fiscal Analysis

Sponsor Substitute for HB 126

Assumptions:

1. No new positions are required to carry out the tasks described below.

2. Well-drilling, hydrographic surveying, and related tasks will be provided through contractual services.

3. The Department's laboratory has the capability to carry out the required water quality analysis.

A major question related to a primary Alaskan resource and a rapidly growing Alaskan industry remains unanswered: Does large scale agricultural development significantly affect the quality of public waters in Alaska? The funds requested in this fiscal note are to support water quality monitoring programs intended to answer that question.

Groundwater quality monitoring is an expensive procedure. Supplemental funds are requested because the activity requires expenditures beyond the fiscal capabilities of the Department's routine operating budget.

Groundwater Quality Monitoring: Nenana-Totchaket

The primary source of water in the Nenana-Totchaket area is groundwater; surface water is scarce. Groundwater sampled during the only water quality study that has been undertaken in the area indicated sufficiently high concentrations of arsenic, nickel, iron, and managanese to suggest that problems could develop if the untreated water were to be used for irrigation or drinking. The quality and dynamics of the groundwater resource is of particular significance in this region because it is entirely underlain by dune sand deposits that vary in thickness from 5-200 feet.

An appropriate water quality monitoring program in this area requires the drilling of ten 300'-500' test wells, and analysis of water samples from each well. The sampling period should be three years.

No new positions are required to carry out this program.

The total cost of the monitoring program is $346,300. Major expenditures are for well-drilling ($184,000), and for water quality analyses ($40,000).

Surface Water Quality Monitoring: Delta

Several baseline water quality studies have been carried out in the vicinity of the Delta Project. Most of these studies, however, were completed prior to extensive agricultural development in the study areas. Only two follow-up studies are scheduled to commence in 1982, neither of which are specifically intended to monitor water quality.

An appropriate water quality monitoring program in this area requires collection and analysis of a total of 135 surface water samples from three stations over a three-year period.

No new positions are required to carry out this program.
The total cost of the monitoring program is ($92,000). Major expenditures are for water quality laboratory analyses ($67,500).

Additional information is attached to this fiscal note.

Department of Environmental Conservation Perspective: Water Quality and Agricultural Development in Alaska

The State of Alaska possesses over 18 million acres of land suitable for intensive agricultural production; nearly 100 million additional acres are suitable for grazing. At present, only a tiny fraction of these lands are devoted to agriculture, and Alaska now imports nearly 95% of its food. In an effort to correct this situation, the state is promoting a program intended to bring 500,000 acres into agricultural production by 1990.

Large scale development of agriculture in Alaska began in 1978, with the launching of the Delta Agricultural Project. The Department of Natural Resources administers land disposal programs through which about 50,000 acres have now been brought to various stages of production. An additional 11,000 acres are scheduled for release in March, 1982 (Delta II East), and an additional 175,000 acres are being considered for agricultural disposal in late 1982 or early 1983 (Nenana-Totchaket).

The rapid development of previously undisturbed land on such a massive scale introduces the threat of significant short term and long term deterioration of water quality in these areas. Potential threats to water quality that are related to agricultural development arise as a result of two major classes of activities: land development and ensuing agricultural operations.

Land development includes surveying, construction of access roads, bridges, and utilities, and land clearing. Primary water quality effects that can result from such activities are increases in sedimentation, suspended load, and concentration of plant nutrients; decreases in light transmission; and changes in temperature.

Agricultural operations include fertilizing, irrigation, seedbed preparation, chemical treatment of seeds, application of fungicides, insecticides, and herbicides, and so on. Primary water quality effects that can result from these activities are similar to those that result from land development, but in addition include introduction of fungicides, insecticides, and herbicides, and decreased concentration of dissolved oxygen.

Alaska's farming community is not unaware of the potential for development of such problems. During early stages of the Delta Project, a poll of the twenty-member Delta Citizen Council indicated unanimous support for allocating state funds for "air and water quality monitoring within the immediate area of the Delta agricultural community," and for assessing "the effect of large scale agriculture on the ecosystem."

Alaska's agricultural lands are being disposed of so rapidly that state agencies have had difficulty completing resource management plans and preliminary resource studies before the lands are released. At present, these plans contain little or no consideration for water quality management.

The Department of Environmental Conservation considers that an appropriate monitoring program should address both of these concerns, and should be carried out as follows:

Delta

Surface water samples should be collected at each of 3 to 5 sites on a biweekly basis from April through September, and bimonthly during the rest of the year. One hundred thirty-five samples should be collected over a three-year study period. Analysis of samples should include the standard suite of water quality parameters, with particular attention to nitrogens and 2-4,D.

Nenana

Groundwater supply sources will predominate in this region; accordingly, water quality studies should focus on this resource. Such studies, exclusive of hydrologic work, should be conducted as described in the report, "Water Resource Investigation of the Nenana Agricultural Project Area," Larry Peterson et. al., 1981. The work requires the drilling of ten 300'-500' test wells in the study area, and analysis of water samples from each well. Analysis of samples should include the standard suite of water quality parameters, with particular attention to arsenic, nickel, and Lindane.

The precise cost of these studies will depend upon how much of the work were to be conducted by DEC staff and lab, and how much conducted by contractual arrangement. A preliminary budget estimate, based on the assumption that most of the work would be assigned by contract, is attached.

Two bills related to agricultural development in the Nenana area (HB 126 and SB 702) are rapidly progressing through the Alaska State Legislature. House Bill 126 proposes allocation of the state funds to the Department of Natural Resources for removal and marketing of timber, agronomic studies, surveys, and planning, processing, and marketing activities. Senate Bill 702 proposes allocation of state funds to the Alaska Agricultural Action Council for survey and disposal activities, land-clearing loans, and road construction.

Allocation of funds for determination and monitoring of water quality in the Delta and Nenana areas have not been included in these bills. The Department of Environmental Conservation proposes that $438,300 be added to them for the purpose of carrying out the water quality studies that are an essential prerequisite to large scale development of agriculture in Alaska.

Estimated Program Budget - Ground and Surface Water Quality Monitoring and Large Scale Agricultural Development

Groundwater Program	FY 83	FY 84	FY 85	
Geologist/Hydrologist - 700 hrs @ $45/hr.	32,500	-------	-------	
Vehicle/Per Diem - 84 days @ $125/day	5,750	2,375	2,375	
Drilling ten 400' wells @ $46/foot	184,000	-------	-------	
Ground Control (survey)	50,000	-------	-------	
Bulldozer (for access) - 200 hrs @ $75/hr plus mobilization	17,000	-------	-------	
Groundwater quality analysis - 80 @ $500 each	20,000	10,000	10,000	
Field monitoring equipment (pumps, generators, sensing devices)	10,000	-------	-------	
Equipment (chemicals, samplers, etc)	2,000	1,000	1,000	
	$321,250	$13,375	$13,375	TOTAL $348,000
Surface Water Program				
Principal - 40 hrs @ $75/hr	5,000	-------	-------	
Biological technican - 360 hrs @ $25/each	3,000	3,000	3,000	
Water quality analysis - 135 @ $500/each	22,500	22,500	22,500	
Vehicle/Per Diem - 48 days @ $125/day	2,000	2,000	2,000	
Administrative overhead/printing	1,500	1,500	1,500	
	$34,000	$29,000	$29,000	TOTAL $92,000

PROGRAM TOTAL: $440,000

ALASKA STATE ASIAN OFFICE

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RECEIVED AUG 12 1981

Charles E. Gibson
Director

Mr. Bob Palmer
Coordinator
Office of the Governor
Pouch AN
Juneau, AK 99811

August 6, 1981

Dear Bob,

The attached is a report on the Alaska Barley feed experiment in Hokkaido. It appears that the Alaskan barley is better in nutrient quality than the Canadian barley sample.

Mr. Sato of the Hokkaido Alaska Kai is planning a trip to Alaska sometime this fall. He requested that I forward this copy to you.

REGARDS,

CG/km

Enc: A report.

cc: Commissioner Webber

Comparative Feeding Trials Between Alaskan and Canadian Barley For Beef Cattle and Swine

by

Coordinator in Hokkaido, Japan:
Dr. Hisatomo Oohara (Director, Dairy Research Institute)

Introduction

Feed barley grain is a most important feed which is being imported from Canada and Australia for all kinds of livestock in Japan,the yearly imports to 1.4 mil. tons. Dairymen and farmers feeding livestock are seeking always after barley more nutritious and less expensive. In yhis connection,Alaskan barley is highly spoken of as a feedstuff rich in protein and energy value than any other barley according to the chemical analysis by researchers of the University of Alaska. Last year 15 tons of Alaskan barl was introduced here for feeding trials under the natural conditions of Hokkaido through kind arrangements of the Alaskan State Government in coop ration with Hokkaido Alaska Association in Sapporo,by permission of the Japanese Government,the importation of grains being controlled in this country.

Experimental Procedure

Subjected to feeding trials were beef cattle at three farms and swine at one farm,using Alaskan barley and Canadian barley.

A. Beef cattle at three farms

1. Shihoro Hinode Beef Cattle Center
   (1) Duration
       91 days from Dec.9,1980, to March 10,1981
   (2) Feeding
       a. Alaskan barley group
          Fed twice a day,daily amounts of consumption were 3.00 kg of Alaskan flaked barley,7.27 kg of concentrate mixture for beef cattle and 0.84 kg of first-cut timothy hay as roughage.
       b. Canadian barley group
          Also fed twice a day,daily amounts of comsumption were 2.87 kg Canadian flaked barley,7.58 kg of concentrate mixture for beef cattle and 0.84 kg of first-cut timothy hay as a roughage.
   (3) Numbers of cattle
       a. Alaskan barley group: 12 Holstein Friesian steer
       b. Canadian barley group: 12 Holstein Friesian steer

2. Kunneppu Hokuren Training Farm

(1) Duration

64 days from Dec.9,1980,to Feb.11,1981

(2) Feeding

a. Alaskan barley group

Alaskan flaked barley,concentrate mixture for beef cattle and hay,which were fed twice a day.

b. Canadian barley group

Similarly,Canadian flaked barley,concentrate mixture for beef cattle and hay,which were fed twice a day.

(3) Numbers of cattle

a. Alaskan barley group: 7 Holstein Friesian steer

b. Canadian barley group: 7 Holstein Friesian steer

3. Higashimokoto Fukutomi Satoh Farm

(1) Duration

67 days from Dec.8,1980,to Feb.12,1981

(2) Feeding

a. Alaskan barley group

Alaskan flaked barley accounted for 30 % of the weight of the total concentrate ration; concentrate mixture for beef cattle accounted for 70 % of it; also 2 kg of hay consisting of timoth and orchardgrass were fed.

b. Canadian barley group

Similar to Alaskan barley group.

(3) Numbers of cattle

a. Alaskan barley group: 15 Holstein Friesian steer

b. Canadian barley group: 15 Holstein Friesian steer

B. Swine at Kunneppu Hokuren Swine Farm

(1) Duration 57 days from

~~Dec.10,1980,to Feb.5,1981~~

(2) Feeding

a. Alaskan barley group

Alaskan ground barley accounted for 30 % of the weight of the total concentrate ration; concentrate mixture for swine account for 70 % of it with selffeeder.

b. Canadian barley group

Canadian ground barley accounted for 30 % of the weight of the total concentrate ration; concentrate mixture for swine accounted for 70 % of it with selffeeder.

(3) Numbers of swine

a. Alaskan barley group: 40 fattening pigs

b. Canadian barley group: 41 fattening pigs

Results

Experimental results at three farms on beef cattle and one farm on swine are shown as follows:

A. Beef cattle

1. Shihoro Hinode Beef Cattle Center

Table 1 Effect of feeding Alaskan barley and Canadian barley on daily gain and feed/gain ratio of beef cattle

Item	Alaskan barley group		Canadian barley group	
	Total	Aver.per head	Total	Aver.per head
Body weight(kg) before the start of the trial(A)	7,135	594.6	7,350	612.5
Body weight(kg) after the finish of the trial(B)	8,172	681.0	8,255	687.9
Total body gain(B-A)	1,037	86.4	995	75.4
Daily gain(kg)	11,396	0.944	10,934	0.829
Amounts of concentrate consumed(kg)	11,207	934	11,528	961
Concentrate/gain		10.81		15.29
Amounts of roughage consumed(kg)	915	76.0	915	76.0
Amounts of total feed consumed during the trial(kg)	12,059	1,005	12,443	1,037
Total feed/gain		11.63		13.75

2. Kunneppu Hokuren Training Center

Table 2 Effect of feeding Alaskan barley and Canadian barley on daily gain and quality of beef of beef steer

Item	Alaskan barley group Aver. per head	Canadian barley group Aver. per head
Body weight(kg) before the start of the trial(A)	612.6	603.0
Body weight(kg) after the finish of the trial(B)	664.0	648.0
Total body gain(B-A)	51.4	44.9
Daily gain(kg)	0.803	0.701
Amounts of barley consumed(kg)	201	201
Amounts of concentrate mixture consumed(kg)	469	469
Hay consumed(kg)	71.6	71.6
Concentrate/gain	13.0	14.9
Weight of beef with bone(kg)	383.3	346.1
Percentage of carcass(%)	57.7	53.4
Grading	good 3; fair 4	good 1; fair 6
Marvelness of fat	0.4	0.7
Area of roas center(cm^2)	41.4	45.7
Color of beef	3.7	3.6
Color of fat	2.1	2.0

3. Higashimokoto Village Satoh Farm

Table 3 Effect of Alaskan barley and Canadian barley on daily gain and feed/gain ratio on beef cattle

Item	Alaskan barley group		Canadian barley group	
	Total	Aver.per head	Total	Aver.per head
Body weight(kg) before the start of the trial(A)	8,309	553.9	7,692	512.8
Body weight(kg) after the finish of the trial(B)	9,409	627.3	8,762	584.1
Total body gain(B-A)	1,100	73.3	1,070	71.3
Average daily gain(kg)	16.67	1.11	16.21	1.08
Amounts of barley consumed (kg)	3,267	217.8	3,267	217.8
Amounts of concentrate mixture consumed(kg)	5,940	396.0	5,940	396.0
Total concentrates(kg)	9,207	613.8	9,207	613.8
Concentrates/gain		8.37		8.60

B. Swine at Kunneppu Hokuren Swine Farm

Table 4 Effect of feeding Alaskan barley and Canadian barley on daily gain and feed/grain ratio on swine.

Item	Alaskan barley	Canadian barley
Body weight at the start of the trial(kg) (A)	52.09	52.04
Body weight at the finish of the trial(kg) (B)	105.74	106.56
Daily gain during the trial(B-A)	53.65	54.84
Duration of the trial(days)	68.5	77.2
Average daily gain(g)	799.0	717.0
Average amounts of feed consumed per head(kg)	200.8	206.8
Feed/grain ratio	3.74	3.77

Discussion

Following is a discussion on the experimental results obtained from feeding trials with Alaskan barley and Canadian barley:

A. Beef cattle

The trials were carried out at the late fattening stage of dairy steer. Generally, concerning the body gain and concentrate/gain ratio, Alaskan barley were superior to those fed with Canadian barley at all experimental farms. Particularly, the weight of carcass was significant at a 2 % level and the percentage of the weight of carcass was significan at a 1 % level statistically. Other items such as body gain, color of fat and beef, and grading, etc., did not indicate the statistical significance between both feeding groups.

This seems to result from the factors that Alaskan barley is better in quality, namely rich in nutrients for beef production and high in conversion of barley to beef than Canadian barley.

B. Swine

The feeding trial to compare Alaskan barley with Canadian barley disclosed that the former was more effective than the latter on body gain during the trial, being significant at a 1 % level, but was not significant on the feed/grain ratio. The quality of pork such as carcass, grading, melting point of fat, the occurrence of soft fatty pork, etc., were not different statistically between both feeding groups.

Summary

Experimental trials were conducted to look into feeding effects of Alaskan barley and Canadian barley on beef cattle at three farms and swine at one farm in Hokkaido,Japan,for a comparison between the two barleys. The results are summarized as follows:

1. Alaskan barley was slightly superior to Canadian barley as feed of beef cattle on body gain,weight of carcass,etc.

2. Similarly,Alaskan barley was more effective as feed of swine than Canadian barley on body gain.

The experimental trials confirmed that Alaskan barley is an excellent feed for beef cattle and swine under natural conditions of Hokkaido.

Acknowledgment

The author takes a delight in acknowledging kindnesses of President K.Satoh of Hokkaido Alaska Association and Former Vice-Governor S.Shibata of Hokkaido Government,who provided helpful advice in promoting mutual communication between Alaska and Hokkaido. He also wishes to thank Governor N.Dogakinai of Hokkaido Government for his encouragement of this research program.

He is particularly indebted to staffs concerned of Hokkaido Government,Hokuren,and the experimental farms. He is also grateful to Mr. T.Ooe of American Center Sapporo for his assistance in preparin this manuscript. Further,he is most appreciative of generosity of Mr.W.I.Palmer,Special Project Coordinator,Office of the Governor of the Alaska State Government and Drs.Thomas and Husby of the University of Alaska for their kind arrangements of this research.

ALASKA
COMMERCIAL
AGRICULTURE
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COOPERATIVE EXTENSION SERVICE, University of Alaska and USDA Cooperating

ECONOMIC INTERRELATIONSHIPS WITHIN ALASKA'S DEVELOPING AGRICULTURAL INDUSTRY

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Assistant Professor &
Resource Economist
Cooperative Extension Service
University of Alaska

January 1982
P-148

ECONOMIC INTERRELATIONSHIPS WITHIN ALASKA'S DEVELOPING AGRICULTURAL INDUSTRY

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P-148

Cooperative Extension Service
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Fairbanks, Alaska 99701
January, 1982

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PREFACE

This bulletin is intended to demonstrate several of the economic interrelationships inherent among the various elements of a modern agricultural industry, an industry of a size significant to Alaska's general economy. The bulletin is not intended to contribute in any significant way to the base of factual information available on specific elements of the industry. Much of the data utilized was borrowed from other publications, from some unpublished sources and from judgements arrived at by various professional agriculturalists within the state. Use of the data is for the specific purpose of demonstrating the importance of systematic linkages among several elements of agricultural production and infrastructure. Included are such elements as a livestock slaughter/processing facility, a grain export facility, the Point MacKenzie project, the Delta projects and others. It is because of the economic importance of these linkages, both for the industry as a whole and for the individual elements within the industry, that they are herein specifically addressed. A better understanding of these interrelationships and their influence can improve the understanding of Alaska's agricultural development as a whole.

I. THE SETTING FOR MAJOR AGRICULTURAL DEVELOPMENT

The Soil Conservation Service, U.S. Department of Agriculture, estimates that within Alaska there are 15,516,000 acres of potential agricultural lands, of which 8,852,000 acres have soils particularly well suited to agricultural development (8). This land-resource base, compared to a total of 20,180 acres in crop production in 1978, demonstrates the potential for development of Alaska's latent agricultural capability (1). Conversely, agricultural development is often considered to refer simply to improving the situation faced by farmers of the 20,000 acres currently being farmed within the state.

The Alaska Agricultural Action Council, created by the State Legislature in 1979 and charged with the planning and management of Alaskan agricultural development projects, has proceeded in attempting to begin development of an ultimately self-supporting agricultural industry that, as a renewable resource based industry, can make a substantial and sustainable contribution to the State's economy.

The challenge of developing a major agricultural sector within the Alaskan economy requires progression well beyond our current agriculture. Viability is dependent on operating competitively with the agricultural system of the rest of the U.S.: a system whose efficiency relates considerably to the economies of scale that have been attained in all elements of the food and fiber production/distribution system. It is thus not feasible to approach development of Alaskan agriculture via gradual expansion from the existing base. Rather, expansion must be premised on adding units of production compatible with the use of the most efficient technology available (i.e. large 4-wheel drive tractors and controlled environment livestock facilities). Such an approach, however, carries a concurrent challenge to simultaneously develop the infrastructure complementary to such production units. That is to say, transportation systems, intermediate and final marketing systems for agricultural inputs and products, processing, credit services, technical assistance, research and extension, a balanced crop-livestock mix, and a favorable policy and regulatory setting are essential as integrated components of an agricultural development program based on creating a competitive and therefore viable agricultural industry.

It is necessary to look at production elements and infrastructure elements of agriculture simultaneously to understand the challenge faced in agricultural development. Development projects, such as the Delta Agricultural project or the Point MacKenzie project can create the opportunity for individuals to establish farm production units (grain farms, dairies, hog farms, etc.) of an appropriate size to utilize the most efficient technology available. Since such farms must ultimately compete with producers "outside", be it on world markets or in our own local markets, they will not be viable simply because they are appropriately sized and utilizing the best technology available. They must also be served by efficient infrastructure which is also competitive with that "outside." To be so, however, the infrastructure must handle a large enough volume to enjoy economies of size similar to those elsewhere in U.S. agriculture.

It is lack of volume through initial development periods that has prompted consideration of state financial assistance in the development process. The question arises, "Can agricultural development be subsidized yet not become an industry dependent on continued subsidization?" Clearly, a farm fully developed with all land in production should be expected to operate at a profit. However, in the initial years the front-end costs of clearing land, purchasing equipment and erecting buildings place considerable financial burden and risk on new farmers. State programs aimed at offsetting these pressures can ease the process of farm development and can speed the achievement of fully developed farms.

The same logic applies to the development of infrastructure. Subsidization should play only the limited role of enhancing the opportunity for initial development, thus permitting survival until sufficient business volume is available to accommodate plant capacities. A grain export terminal provides a good example. For such a terminal to be cost competitive with systems elsewhere in North America it must be designed to have a put-through capacity of the magnitude of hundreds of thousands of bushels per year. In consequence, to operate efficiently the plant would have to handle a volume approaching this magnitude each year. The crop-land required to meet this production level plus production for in-state use will require several years to be surveyed, released by the State, cleared and prepared for crops. While an export facility will encourage grain production by insuring a market for all production, several years will be required for production to increase to levels sufficient for the facility to cover all costs. Again, it is lack of volume through the development period that raises the need for state provided development incentive.

Relative to the wisdom of providing incentives for the development of farmsteads, the Delta Agricultural Project provides a demonstrated example. As suggested by the report by Faris and Hildreth (3), such a project would demonstrate whether or not relatively large parcels of land could be brought under production in a fairly rapid fashion. It is being done. Land is being cleared within a reasonable time schedule and at a reasonable cost. Efficient technology is being adapted (i.e. equipment and agronomic techniques), and crops are being produced, dried and properly stored. On-farm production is benefiting from the economies of scale available elsewhere in U.S. agriculture and we can see that clearing and production itself can be economically undertaken (5).

Yet it is not a fully viable economic endeavor. To be so, it must be accompanied by input and product markets designed to handle a volume of activity sufficient to enjoy technologically available economies of scale. Such economies for farm production were systematically incorporated into the planning of the Delta Project, and so must they be incorporated into the planning of infrastructure development. A more complete discussion of the possible merits of short-term subsidy for the purpose of stimulating development has been presented by the Alaska Economic Information and Reporting System (2:15-22).

Agricultural potential clearly exists in Alaska. The industry offers a development opportunity based on renewable resource use. Current oil revenues can provide the capital necessary to reduce diseconomies inherent in the development process. Improved understanding of the economic interrelationships within an agricultural industry is necessary as decisions are made to commit public funds and land resources to agricultural development.

II. SCOPE OF ANALYSIS

Development of Alaskan agriculture implies the potential for production of several different commodities. Grains, forage, and vegetable production as well as other crops, such as grass seed and oil seed crops, have known agronomic potential in Alaska and could conceivably become part of the agricultural industry. Other farm production possibilities include livestock: swine, beef, dairy and assorted small livestock. In Figure 1, these -farm production enterprises are schematically related to the basic farm-input enterprises and farm product processing and marketing enterprises. Seed, fertilizer and chemical and equipment suppliers will be required for all forms of crop production. In turn, swine, beef, dairy and other livestock production requires a feed grain base and the intermediate service of feed milling. Dairy production also requires a forage production base and beef production will require both rangeland and forage production.[1] Beef finishing is assumed to be carried out in a central feed lot.

In addition to in-state use of grain for livestock feed, full-scale grain production also requires export marketing and consequently, an export facility. Also required for regula- marketing of grain, be it for export or in-state movements are country elevators to consolidate, store and handle grain.

Beef, swine and dairy production all require slaughter/ processing facilities and distribution systems for meat products.

[1]The term "forage" is used to identify hay, silage and improved pasture.

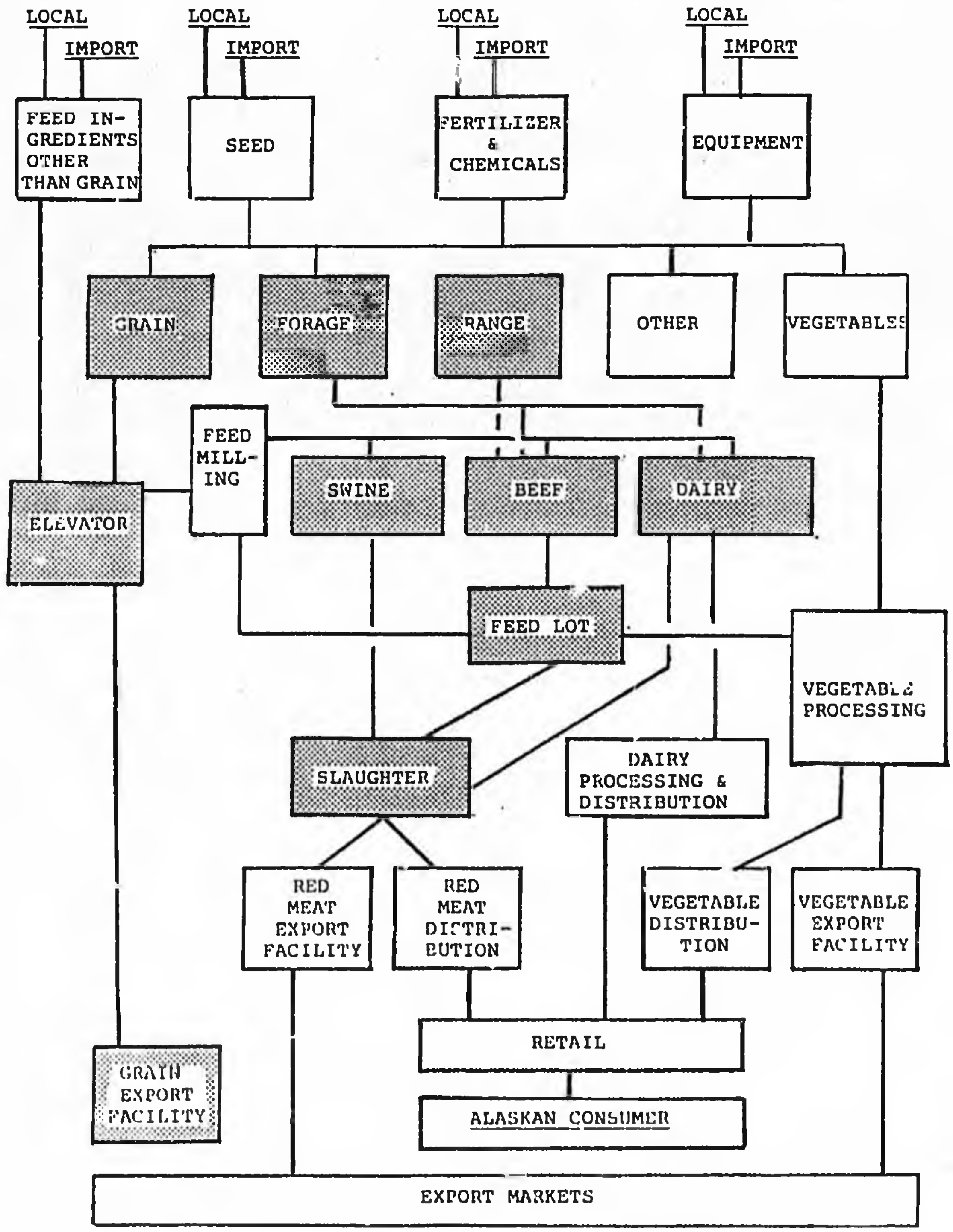

Figure 1 Schematic diagram of linkages between sectors of an agricultural industry.

Dairy production also requires specific processing and distribution of dairy products. Vegetable production requires a unique processing and distribution system.

While Figure 1 does not depict all possible relationships among enterprises, it does depict the major associations and product movement possibilities. The relationships among those enterprises denoted by shaded backgrounds in Figure 1 are considered in this bulletin. This limitation results from three factors: 1) It is in these areas that the greatest public interest has been shown, 2) State involvement has focused in these areas, and 3) It is assumed that development of these elements of the agricultural industry can provide the agricultural base for other elements of the industry to evolve unaided in response to economic opportunity either during or after this decade.

The final assumptions made for the purpose of limiting the scope of this report deal with the agricultural base existing prior to State efforts to encourage major expansion of agriculture and with small scale and/or non-project agriculture. Neither pre-exisitng nor non-project agriculture have been explicitly considered in this report. While both can be major contributors to successful growth of the industry, it was assumed they would not be a major determinant of the success or failure of an agricultural industry of the scale being addressed in this report. It should be emphasized that this assumption is made solely to facilitate analysis. It is not intended to reflect on the actual role of non-project agriculture in general agricultural development.

III. ANALYTIC APPROACH

While analysis of the feasibility of several specific agricultural projects has been undertaken (4,6,7,9), there has been little work to evaluate interrelationships existing between various projects. This report specifically addresses these interrelationships. The analysis is quantitative but results should be viewed only in a qualitative sense. Effective quantitative results would require a data base far superior to that currently available and collection of such data will be costly. However, via use of data currently available, this analysis has been conducted in order to demonstrate the magnitude and direction of influence of interrelationships within an agricultural industry.

Fixed and variable costs were roughly estimated for the various elements of the industry to be analyzed. Next, grain and livestock production schedules were projected. General industry requirements necessary to accommodate these production levels were then estimated. As an example, these estimates included range requirements for beef production and facilities requirements for swine production.

Ownership costs, operating costs, tariff levels and operating deficits were projected for an export facility, country elevators, a slaughter facility and a feed lot based on the assumed production schedule and the estimates of industry requirements and cost structures. Investment costs and schedules were also developed.

Importantly, infrastructure tariff rates used in this analysis were set as constant over time and determined to be in an amount equal to that required to break-even upon reaching the full level of projected production. The graph in Figure 2 can help to explain this approach. Curve A depicts the total cost for handling increasing volumes of product through a facility: grain through an export terminal or livestock through a slaughter facility for example. Curve B depicts total earnings. With a fixed tariff charge and steadily increasing product volumes moving through the facility, total earnings would also increase steadily as shown. Envision the horizontal axis to represent a series of production periods (days, months or years) with product put-through increasing in each period. With the vertical axis representing dollars, the distance between the two curves represents the difference in costs and revenues for each period. Below the point of intersection of the curves, costs exceed earnings. Beyond that point, revenues exceed costs and therefore represent profitable operation. The shaded area between the curves and below the point of intersection represents what could be termed "development cost." This is a "cost" that would not exist if sufficient crop and livestock production could be instantly brought on-line to fully utilize major infrastructure facilities.

This "development cost" is estimated for each major element of infrastructure discussed in this bulletin. These estimates are intended to demonstrate relative magnitude of this "development cost" among different elements of agricultural infrastructure. A substantially better data base would be necessary for accurate estimation.

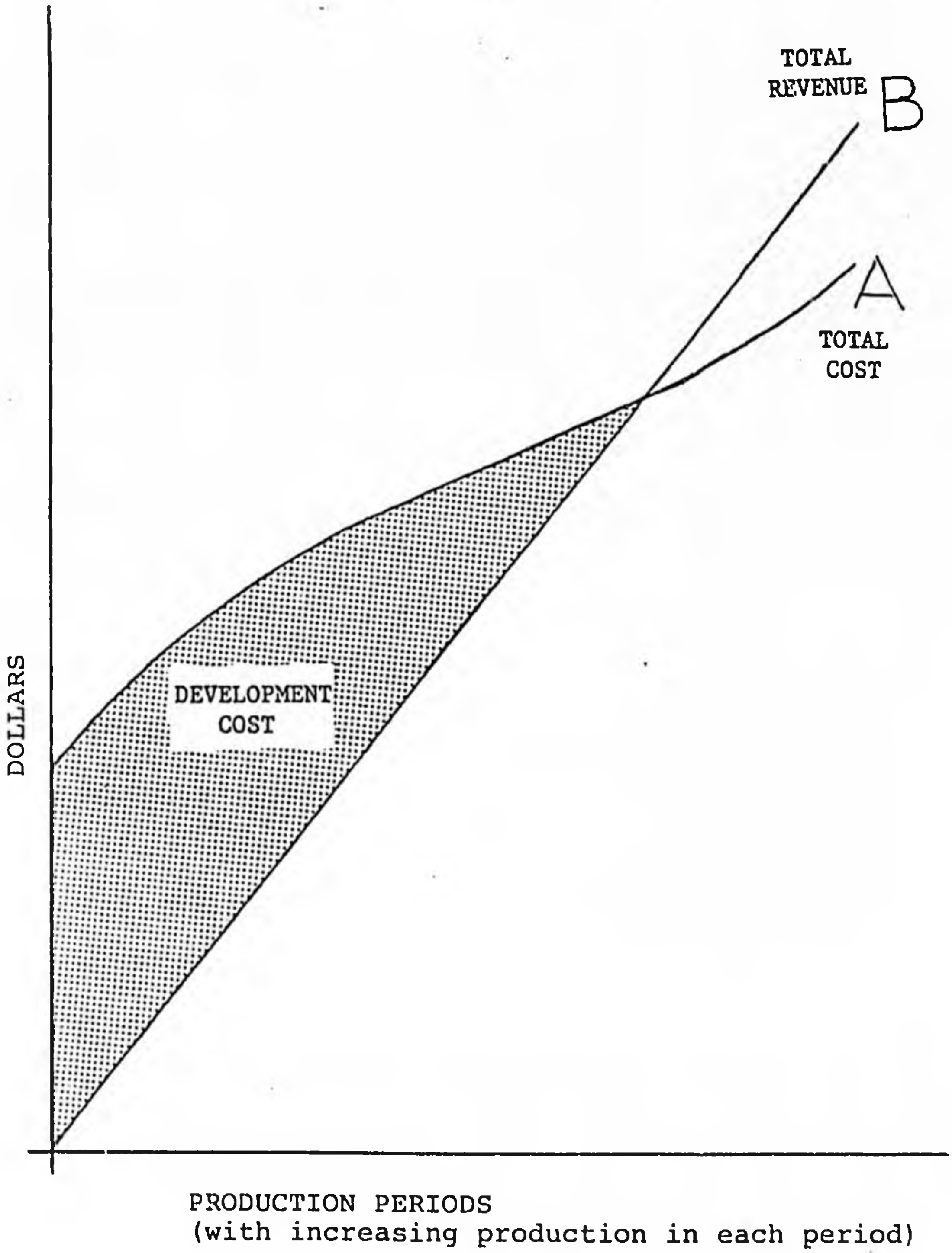

Figure 2. A graphic example of "development cost."

IV. ANALYSIS OF INDUSTRY COMPONENTS

Central to this analysis are four key facilities: a grain export terminal, a system of country elevators, a livestock slaughter/processing facility and a beef feed lot. Looking back at Figure 1, it can be seen that an export facility and country elevators (plus implied transportation) are the two infrastructure requirements necessary to link Alaska grain production to world export markets. Comparably, a feed lot and a slaughter/processing facility are the link between farm livestock production and a distribution system which can provide red meat products to the Alaskan consumer.

The common element to these two very different market channels can be traced back specifically to the grain production base. Movement of grain can either be into direct export, or when fed to livestock, into in-state retail food markets.

While grain is the specific link between the two market channels, all crop production competes for the same land base. Thus, increased red meat production will negatively affect grain export volume in two ways. First grain use would be increased by livestock production, thus directly reducing volumes available for export. Secondly forage and/or range production would need to increase to accommodate increased red meat production and this in turn would indirectly cut export grain volume since use of some land would shift from grain production to allow increased forage or range production.

Export is typically a residual market and has consistently been viewed as such for Alaska. In other words, local demand for grain will be met and the residual supply will move into the export market. In this report, the livestock market channel is first considered, a projection of total grain production is made and finally the grain marketing channel is addressed.

Livestock Production and Processing. The Nenana Livestock Report (4) provides the basis for assessment of the livestock marketing channel. In that report, total construction costs for a slaughter/processing plant with capacity to handle 70,000 head of swine and 26,000 head of beef annually was estimated to be $3,517,900. Completion date on the facility was suggested to be mid 1984 with initial work beginning in 1981. The schedules of development of livestock production units shown in Table 1 were assumed to be as rapid a development scenario as could be expected to result if the slaughter facility were built.

TABLE 1. Development of Livestock Production Units

Year	81	82	83	84	85
150 sow/unit swine operations			10	11	10
250 cow/unit beef operations	.	20	20		
150 cow/unit dairies (Pt. MacKenzie)	5	10	5		

If all female calves were used as replacements or to increase breeding herds until an annual beef production rate of 23,000 head per year was obtained, the production schedules listed for all species at the top of Table 2 would be attained by this development scenario.

Ownership costs for the slaughter/processing plant are also presented in Table 2.[2] Since the plant would be in operation for the last half of 1984, ownership costs accrued in that year are one half of that in later years.

From the Nenana Livestock Report operating cost per head was determined to be $37.98 for beef and $13.66 for pork with the plant operating at capacity (4). Because operation below capacity can be expected to result in operating inefficiencies, per unit operating costs were adjusted upward in early years of plant operation.[3] Per unit operating costs times the number of head processed provides the total annual operating costs (O.C.) for each species as listed in Table 2.

Total cost of slaughter and processing per head for each species is listed in this table. A fixed tariff, equal to per head cost when the plant is operating at capacity, was set for all years. Deficit per head for each species, calculated by subtracting the fixed tariff from per head cost in each year, is listed. This, multiplied by number of head, yields total deficit for each year.

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[2] $\text{Annual Interest Expense} = \frac{\text{Investment Cost}}{2} (.06)$

$\text{Annual Depreciation} = (\text{Investment Cost}) (.03)$

[3] Per Unit Operating Costs:

Beef: $\text{Unit Cost} = [2 - \frac{1}{26{,}000} (\text{no. head})]37.98$

Pork: $\text{Unit Cost} = [2 - \frac{1}{70{,}000} (\text{no. head})] 13.66$

TABLE 2. Operating Budget: Slaughter Facility

Year	84	85	86	87	88	89	90
Head of Pork	11,788	47,772	69,812	70,000	70,000	70,000	70,000
Head of Dairy Beef	1,025	1,895	2,300	2,300	2,300	2,300	2,300
Head of Beef	2,850	5,700	6,755	8,864	15,520	22,413	23,700
OWNERSHIP COSTS:							
Interest on Investment	52,769	105,537	105,537	105,537	105,537	105,537	105,537
Depreciation	87,948	175,895	175,895	175,895	175,895	175,895	175,895
OPERATING COSTS:							
Manager's Salary	32,501	65,000	65,000	65,000	65,000	65,000	65,000
Other O.C. (Pork)	294,932	859,783	956,193	956,200	956,200	956,200	956,200
Other O.C. (Beef)	272,411	491,577	568,045	665,955	889,736	985,060	987,480
TOTAL COST	740,560	1,697,792	1,870,670	1,968,587	2,192,368	2,287,692	2,290,112
Total Cost/hd. Pork	32.37	21.62	16.18	16.13	16.13	16.13	16.13
Fixed Tariff	16.13	16.13	16.13	16.13	16.13	16.13	16.13
Deficit/hd. Pork	(16.24)	(5.49)	(.05)	-0-	-0-	-0-	-0-
Total Cost/hd. Beef	92.65	87.76	81.86	75.17	59.65	46.87	44.64
Fixed Tariff	44.64	44.64	44.64	44.64	44.64	44.64	44.64
Deficit/hd. Beef	(48.01)	(43.12)	(37.22)	(30.53)	(15.01)	(2.23)	-0-
Total Deficit	(377,476)	(588,902)	(340,518)	(340,837)	(267,478)	(55,110)	-0-
Cumulative Deficit	(377,476)	(966,378)	(1,306,896)	(1,647,733)	(1,915,211)	(1,970,321)	

The final line in the table is the cumulative deficit from operation through the development years. This amount can be referred to as the "development costs."

Head of beef to be feed lot finished annually was derived from the projected beef production schedule and is presented at the top of Table 3. The difference between head of beef produced, Table 2, and the head of beef finished, Table 3, is due to cull cows which would be used as utility beef and would not be feed lot finished.

The Nenana Livestock Report estimated construction costs of a feed lot at $500,000. Using that figure as base, this analysis assumes that the feed lot could be built in two phases, the first requiring a $300,000 investment and the addition costing $200,000. Using the same methods for calculating interest and depreciation expense as were used earlier for the slaughter facility, ownership costs are listed in Table 3. A full-time manager, salaried at $40,000 per year, was assumed necessary in the first year of operation and thereafter. Other operating expenses, excluding feed costs, were estimated to be $16.67 per head.

Again a fixed tariff was set for all years as equal to the per unit cost of operation when at full production. The per head deficit and the cumulative deficit are listed at the bottom of the table. The cumulative deficit or "development cost," is $208,901.

<u>Barley Production.</u> Estimation of total barley production is

TABLE 3. Operating Budget: Feed Lot

Year	84	85	86	87	88	89	90
Head of Beef Finished	2,350	4,700	5,570	7,309	13,526	20,028	21,182
OWNERSHIP COSTS:							
Interest	9,000	9,000	9,000	9,000	15,000	15,000	15,000
Depreciation	15,000	15,000	15,000	15,000	25,000	25,000	25,000
Subtotal	24,000	24,000	24,000	24,000	40,000	40,000	40,000
OPERATING COSTS:							
Management	40,000	40,000	40,000	40,000	40,000	40,000	40,000
Other	39,175	78,349	92,852	121,841	225,478	333,867	353,104
Subtotal	79,175	118,349	132,852	161,841	265,478	373,867	395,104
TOTAL COST[1]	103,175	142,349	156,852	185,841	305,478	413,867	435,104
Total Cost/hd.[1]	43.90	30.29	28.16	25.43	22.58	20.66	20.54
Fixed Tariff[1]	20.54	20.54	20.54	20.54	20.54	20.54	20.54
Deficit/hd.	(23.36)	(9.75)	(7.62)	(4.89)	(2.04)	(.12)	-0-
Total Deficit	(54,896)	(45,825)	(42,443)	(35,741)	(27,593)	(2,403)	
Cumulative Deficit	(54,896)	(100,721)	(143,164)	(178,905)	(206,498)	(208,901)	

[1] Does not include feed.

based on the projection of Delta and Nenana area agricultural lands being phased into production over a seven year period as shown in Table 4. Of the total acreages available for each of the four projects, it is assumed that 60 per cent will be in barley production each year. The acreages listed in the first four lines of this table are the projected yearly barley acreages. Assuming a per acre yield equal to the U.S. national average, 1.15 tons per acre total tonnage of barley production rounded to the nearest thousand is presented for each year.

Feed grain use was projected from the livestock production schedule and based on the following rates of livestock feed consumption: 724 pounds of barley per market hog produced, 1.45 tons of barley per head of finished beef produced and 2.90 tons of barley annually per lactating dairy cow. Total projected annual use of barley by these three livestock species is listed as "in-state use."

The difference between the projections of total production and total livestock feed use is the quantity available for export. This is presented on the final line of Table 4.

Grain Handling Facilities. Based on the quantities of barley available for export a projected operating budget for an export facility is presented in Table 5. With construction costs for an export facility estimated at $5,700,000, average depreciation and interest expense were calculated in the same manner as for the slaughter facility. Estimates of insurance, maintenance and all operating costs as well as the construction cost were taken

TABLE 4. Projected barley acreages, production and in-state and export use.

	1981	1982	1983	1984	1985	1986	1987
Delta I	16,000	30,000	36,000	36,000	36,000	36,000	36,000
Delta II	-0-	-0-	5,000	15,000	27,000	27,000	27,000
Nenana I	-0-	-0-	-0-	5,000	27,000	27,000	27,000
Nenana II	-0-	-0-	-0-	-0-	15,000	50,000	77,000
Total Acres	16,000	30,000	41,000	56,000	105,000	140,000	167,000
Total Tons	18,000	35,000	47,000	64,000	121,000	161,000	192,000
In-State Use	7,000	11,238	17,731	25,082	35,901	52,349	63,474
Export	11,000	23,762	29,269	38,918	85,099	108,651	128,526

TABLE 5. Operating Budget: Export Facility

Year	81	82	83	84	85	86	87
Tonnage	11,000	23,762	29,269	38,918	85,099	108,651	128,526
OWNERSHIP COSTS:							
Interest on Investment	171,000	171,000	171,000	171,000	171,000	171,000	171,000
Depreciation	188,100	188,100	188,100	188,100	188,100	188,100	188,100
Property Insurance	113,000	113,000	113,000	113,000	113,000	113,000	113,000
General Maintenance	20,000	20,000	20,000	20,000	20,000	20,000	20,000
Subtotal	492,100	492,100	492,100	492,100	492,100	492,100	492,100
OPERATING COSTS:							
Inventory Insurance	2,000	4,000	6,000	8,000	18,000	24,000	30,000
Management & Labor	52,500	75,450	85,041	102,875	198,679	253,604	300,067
Utilities	2,000	4,752	5,854	7,784	17,019	21,730	25,705
Miscellaneous	1,000	2,000	3,000	4,000	9,000	12,000	15,000
Subtotal	57,500	86,202	99,895	122,659	242,698	311,394	370,772
TOTAL COST	549,600	578,302	591,995	614,759	734,798	803,494	862,872
Total Cost Per Ton	49.96	24.32	20.23	15.80	8.63	7.40	6.71
Fixed Tariff (assumed)	6.71	6.71	6.71	6.71	6.71	6.71	6.71
Deficit Per Ton	(43.25)	(17.63)	(13.52)	(9.09)	(1.92)	(.69)	(0.00)
Total Deficit	(475,750)	(418,424)	(395,717)	(353,765)	(163,390)	(74,969)	
Cumulative Deficit	(475,750)	(894,174)	(1,289,891)	(1,643,656)	(1,807,046)	(1,882,015)	

from initial projections made by the Alaska Agricultural Action Council in January 1981. With a put-through volume of 128,526 tons in 1987 the annual total cost is $862,872 or $6.71 per ton. Fixing the tariff at $6.71 per ton for all years of operation, the operating deficit per ton was calculated. The final two lines in the table are total deficit per year and cumulative deficit. Under this scenario the total cumulative deficit or the amount being termed "development costs" is $1,882,015.

Annual production of barley on 62,000 acres at Delta and 104,000 acres at Nenana is assumed to be served by a system of 5 country elevators each with annual put-through, storage and handling capacity of 40,000 tons and costing $1,650,000 each to construct. The first of these five facilities, the existing Delta facility, is assumed to be at operational capacity and invested to the $1.65 million level by 1982. Thereafter, complete facilities are projected to be constructed as required by volumes of grain produced. This implies an additional facility at Delta in 1983 and one facility per year in 1984, 1985 and 1986 at Nenana. Average interest expense and depreciation expense are listed under ownership costs in Table 6. Work by Thomas shows per ton operating costs of such a facility to decline from $51.16 per ton at the 3800 ton put-through level to $15.62 per ton at a put-through level of 29,000 tons annually (9). Operating cost projections in the table are the sum of the annual operating cost calculated for each of the five facilities. Individual facility operating costs were calculated based on annual put-through times a per unit

TABLE 6. Operating Budget: Country Elevators

Year	81 & prior	82	83	84	85	86	87
Tonnage	18,000	35,000	47,000	64,000	121,000	161,000	192,000
OWNERSHIP COSTS:							
Interest on Investment	35,485	49,500	99,000	148,500	198,000	247,500	247,500
Depreciation	39,033	54,450	108,900	163,350	217,800	272,250	272,250
TOTAL OPERATING COSTS	315,687	546,345	810,669	1,134,420	1,952,975	2,577,940	2,999,833
TOTAL COST	390,205	650,795	1,018,569	1,446,270	2,368,775	3,097,690	3,519,583
Total Cost Per Ton	21.68	18.59	21.67	22.60	19.58	19.24	18.33
Fixed Tariff	18.33	18.33	18.33	18.33	18.33	18.33	18.33
Deficit Per Ton	(3.35)	(.26)	(3.34)	(4.27)	(1.25)	(.91)	0
Total Deficit	(60,300)	9,100	(156,980)	(273,280)	(151,250)	(146,510)	0
Cumulative Deficit	(60,300)	(69,400)	(226,380)	(499,660)	(650,910)	(797,420)	

unit cost which was linearly proportionate to the costs reported by Thomas. In other words, the cost figure used was $15.62/ton when put-through was 29,000 tons or greater but with put-through between 3,800 and 29,000 tons, the cost was between $15.62 and $51.62/ton depending on specific tonnage level.

Operating costs are inclusive of all storage, drying and handling expense. Thus the fixed tariff, set equal to per ton total costs in 1987, represents the total charge on a per ton basis for average storage, handling and drying of a farmer's crop. Per ton and total deficit of operation are presented for this scenario of development of a system of country elevators. The cumulative deficit or "development cost" is $797,420.

Investment Summary. Construction of a modern, slaughter/ processing facility was assumed as an initial point from which to begin this analysis of the interrelated nature of the components of an agricultural industry based on feed grain and livestock production. Livestock production schedules were then developed that would allow full utilization of that facility as quickly as practically possible. Construction of feed lot facilities compatible with the beef production schedule was outlined and a schedule of barley production was projected based on development plans for the Delta and Nenana areas.

Subtracting the estimated feed grain requirements of the scheduled livestock production from the scheduled total barley production, the net difference is the surplus available for export. Since feed grain would need to be stored, dried and handled for both export or in-state feed use, the system of country elevators included in this analysis are of sufficient capacity to handle all grain produced. Grain movement through the export facility, however, was the residual supply remaining after satisfying in-state needs for feed grain.

In Table 7 the investment costs are summarized for the four key types of infrastructure: feed lot, slaughter facility, country elevators and export facility. Also investment requirements for the facilities, equipment and stock are listed for all crop and livestock production based on the production schedules that have been outlined. In the case of grain farms (Delta I and II and Nenana I and II), investment costs were based on survey data used in Costs of Production: Barley (5). Investment requirements listed in the table were calculated at $27,000 investment in shop and equipment storage buildings per 1000 acres and at $160,000 investment in equipment per 1000 acres.

Based on the report by Lewis, et.al., investment in the Point MacKenzie project includes $1600 per milk cow, $1,241,711 facilities cost per 150 cow dairy and $150,000 cost in crop equipment per 150 cow dairy (6).

Investment levels for both swine and beef operations were based on the report by Featherstone Corporation (4). Swine production investment includes a facility investment of $500,000 per 150 sow unit and $90,000 investment in breeding stock per unit. For beef, investment required is $1386.67 in breeding stock and $1933.33 in facilities and equipment per cow unit.

TABLE 7. Facilities, Buildings, Equipment and Stock Investment Schedules

	81 & prior	82	83	84	85	86	87	88
FARM & RANCH INVESTMENT								
Delta I								
Buildings	432,000	378,000	162,000					
Equipment	2,560,000	2,240,000	960,000					
Delta II								
Buildings			135,000	270,000	324,000			
Equipment			800,000	1,600,000	1,920,000			
Nenana I								
Buildings				135,000	594,000			
Equipment				800,000	3,520,000			
Nenana II								
Buildings					270,000	945,000	594,000	
Equipment					2,400,000	5,600,000	3,520,000	
Point MacKenzie								
Facilities	6,208,555	12,417,110	6,208,555					
Crop Equipment	750,000	1,500,000	750,000					
Stock	720,000	2,344,000	2,712,000	1,272,000	184,000			
Swine Production								
Facilities			5,000,000	5,500,000	5,000,000			
Stock			900,000	990,000	900,000			
Beef Production								
Facilities & Equip.		9,666,650	9,666,650	3,576,660	7,153,321	8,477,652	7,555,454	2,654,462
Stock		6,933,350	6,933,350	2,565,340	5,130,679	6,080,548	5,419,106	1,903,898
Subtotal	10,670,555	35,479,110	34,227,555	16,709,000	27,396,000	21,103,200	17,088,560	4,558,360
INFRASTRUCTURE INVESTMENT								200,000
Feed lot				300,000				
Slaughter Facility	1,172,633	1,172,633	586,387	586,317				
Country Elevators								
Delta	1,182,835	467,165	1.650,000					
Nenana				1,650,000	1,650,000			
Export Facility	5,700,000							
Subtotal	8,055,468	1,639,798	2,236,317	2,536,317	1,650,000	1,650,000	-0-	200,000
TOTAL	18,726,023	37,118,908	36,463,872	19,245,317	29,046,000	22,753,200	17,088,560	4,758,360
CUMULATIVE TOTAL	18.726,023	55,844,931	92,308,803	111,554,120	140,600,120	163,353,320	180,441,880	185,200,240

Breeding stock cost includes bulls as a stocking ratio of 1 per 15 cows.

In the table total annual investment requirement for farm and ranch development and for infrastructure are shown separately as the subtotal in each respective category. The sum of the two provides the total investment requirement and the final line of the table provides the cumulative investment required year by year.

Table 8 and 9 complete the summary of investment requirements. Table 8 lists the clearing investment required. For the Delta and Nenana Projects, a clearing cost of $165 per acre was used. This is the loan amount that was available for clearing land on the original Delta Agricultural project. Acreages cleared are fifty percent greater than the barley acreages listed in Table 4 because it is assumed that only two-thirds of the land will be cropped annually to barley. For Point MacKenzie, 500 acres were assumed necessary for silage and hay production per 150 cow dairy. A clearing cost, based on initial estimates by the Alaska Agricultural Action Council, of $230 per acre was used. For range and hayground for beef production, it was assumed that four acres would be required per cow-calf unit and that clearing costs would be the same as for grain farms, $165 per acre. All land was assumed to be cleared one full year prior to production except in the case of dairies. Point MacKenzie land was assumed to be cleared in the winter immediately prior to cropping.

Table 9 lists the land purchase investments necessary under

TABLE 8. Landclearing Costs Investment Schedule

	81 & prior	82	83	84	85	86	87
Delta I $165./acre	7,425,000	1,485,000					
Delta II $165./acre		1,237,500	2,475,000	2,970,000			
Nenana I $165./acre			1,237,500	5,445,000			
Nenana II $165./acre				3,712,500	8,662,500	6,682,500	
Point MacKenzie $230./acre	287,500	862,500	862,500	287,500			
Range and Hayland (Cattle) ($165./acre)	3,300,000	3,300,000	1,221,000	2,442,000	2,894,100	2,579,280	906,180
TOTAL	11,012,500	6,885,000	5,796,000	14,857,000	11,556,600	9,261,780	906,180
CUMULATIVE TOTAL	11,012,500	17,897,500	23,693,500	38,559,500	50,107,100	59,368,880	60,275,060

TABLE 9. Land Purchase Costs Investment Schedule

	81 & prior	82	83	84	85	86	87
Delta I $51./acre	2,958,000						
Delta II $100/acre	4,000,000						
Nenana I $100/acre		4,000,000					
Nenana II $100/acre			10,000,000				
Point MacKenzie $100/acre	1,000,000						
Range & Hayland (Cattle) $100/acre	2,000,000	3,000,000	740,000	1,480,000	1,754,000	1,563,200	549,200
TOTAL	9,958,000	6,000,000	10,740,000	1,480,000	1,754,000	1,563,200	549,200
CUMULATIVE TOTAL	9,958,000	15,958,000	26,698,000	28,178,000	29,932,000	31,495,200	32,044,400

this analytic development scenario. Purchase price per acre listed in the table are the actual sales price for Delta I and the minimum statutory price on all other projects. It is important to note that this investment represents a purchase by individuals of land currently owned by the state. Land is an obviously essential investment within the agricultural industry but from the state perspective, income from sale of agricultural land is an income or benefit from agricultural development.

V. IMPLICATIONS OF DEVELOPMENT DELAYS

This analysis, though relying on an admittedly weak data base, has quantitatively related several of the subcomponents of Alaska's developing agricultural industry to one another. In order to do so, specific development schedules for each sub-component were assumed. The principal purpose of the analysis, however, is to demonstrate the magnitude and direction of influence of interrelationships among sub-components of the industry. To do so, four different deviations from the base development scenario are examined.

Delayed Grain Production. What is the effect of delaying the development schedules of Delta II and Nenana I and II by one year? The principal influence of this delay would be upon the export facility assuming all in-state demand for feed-grain to be met in preference to export. Grain production would still be sufficient for scheduled livestock production. Construction of additional country elevators could be delayed in correspondence to grain production. While the livestock sector would not be directly affected, the economic benefit of volume would be reduced for agricultural supplies (equipment, chemicals, fertilizer, seed).

Quantity available for export in years 1983 through 1987 would be reduced to 23,519 tons, 21,668 tons, 28,749 tons, 68,401 tons and 97,476 tons, respectively. With per ton operating costs of the export facility proportionate on a volume basis to those of the original operating budget, annual operation deficit would increase to $420,049 in 1983, $428,160 in 1984, $397,886 in 1985, $232,563 in 1986, and $116,971 in 1987. The cumulative deficit or "development cost" would be $2,489,803, an increase of $607,788 from the original development schedule.

Delayed Livestock Production. With construction of a slaughter/processing facility as originally projected but with a one-year delay in projected increases in livestock production, primary economic impact would obviously be on the slaughter facility. Offsetting this impact, however, would be an increase in export sales and thus increased use of the export facility. Added "development cost" to the slaughter facility would be $281,432. That is, one more year of ownership expenses would be incurred prior to achieving a put-through sufficient for profitable operation. Though logically the construction of a feed lot would be delayed in conjunction with delay of livestock production, if it were not, ownership cost for an additional year would accrue to the "development cost" of this facility also.

As a result of this delay in livestock production, barley for export would increase to 28,000 tons, 35,762 tons, 46,269 tons, 95,918 tons and 125,099 tons respectively in years 1982 through 1986. This increase in put-through at the export facility would reduce the cumulative deficit or "development cost" of this facility to $1,703,127, a reduction of $178,888.

Delayed Slaughter Facility and Livestock Production. If construction of the slaughter/processing and the feed lot facility were delayed one year in accompaniment of a one-year delay in livestock production, the "development cost" of these facilities would be unchanged. Thus delaying development of the entire livestock sector by one year would show no added development cost for this sector but the $178,888 reduction in the "development cost" of the export facility would still be attained.

Delayed Rangeland Development. Within the initial development scenario, a substantial program of range and hayland development for beef production was included. The schedule required approximately 100,000 acres of rangeland by 1987. If livestock production were to remain on schedule while range and hayland development fell behind schedule, land for grain production would have to shift to rangeland. In addition to the direct effect of grain use by the livestock industry on export volume, land conversion from grain to range and hay would cut into the barley volume produced. If twenty percent of the Delta and Nenana land were converted from barley to hay and rangeland for the years from 1982 to 1986, total grain production would also be reduced by twenty percent in these years. Thus export volume would fall to 12,762 tons, 15,069 tons, 19,718 tons, 48,099 tons, and 59,651 tons respectively for the five years. As a result, the "development cost" of the export facility would increase to $2,422,769, which is an increase of $540,754 over the base projection.

VI. CONCLUSIONS

The term "development cost" has been used in this report to describe the diseconomies of operating agricultural facilities at low volume put-through levels as the basic production industries are being developed. Slaughter facilities, a feed lot, country elevators and an export facility all provide essential services necessary to establishing a viable grain and livestock based agricultural industry. They perform basic functions necessary to linking production agriculture to product markets and are essential to encouraging actual farm production. Because of the scale of plant design necessary to achieve the economies of scale available to competing agriculture elsewhere in North America, facilities considered for Alaska will initially have excess capacity until sufficient farm production of grain and livestock can be developed. The "development costs" reported in this analysis demonstrate the direction and general magnitude of influence that the development scheduling of various sub-sectors can have on one another. Even recognizing the weakness of data used, it is clear that delays in land development will severely impact the economic performance of new infrastructure. Also the competition of grain and livestock for the land resource has been demonstrated. Clearly, construction of a slaughter facility must be accompanied by rangeland development. Otherwise, diversion of land from grain production will seriously dampen the economic performance of grain exporting activities.

Effective market access is essential to the growth of Alaskan agriculture. Development of infrastructure will provide market access and thus create a favorable setting for increased crop and livestock production if tariffs are competitive with those elsewhere in U.S. agriculture. The "development costs" mark the degree of lack of competitiveness associated with low product volumes in development years; they are relatively short term costs that must be borne by the industry and/or by state governmental support until production volumes are sufficient to fully utilize new infrastructure.

Decisions regarding development of Alaskan agriculture become increasingly complex as that development progresses. Not only does the viability of individual projects need to be assessed, but also the effects of such projects on the existing agricultural base and on general development plans must also be evaluated. The same is equally, if not more importantly, true of the impacts of delays in proposed development plans. Agriculture is a highly complex and interrelated industry. Economic interrelations within the industry must be fully recognized and incorporated in the planning process if "development costs" are to be kept at a minimum.

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