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AN ECONOMIC OUTPUT AND PRICING POLICY FOR SERVICE CO-OPERATIVES: A CASE STUDY OF ALBERTA CO-OPERATIVE SEED CLEANING PLANTS

by

© J. KARIBONDO-KARABASHENGHEIRE AHIMBISIBWE

A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES AND RESEARCH

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE

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THE UNIVERSITY OF ALBERTA

FACULTY OF GRADUATE STUDIES AND RESEARCH

The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies and Research, for acceptance, a thesis entitled "An Economic Output and Pricing Policy for Service Co-operatives: A Case Study of Alberta Co-operative Seed Cleaning Plants" submitted by J. Karibondo-Karabashensheire Ahimbisibwe in partial fulfillment of the requirements for the degree of Master of Science.

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ABSTRACT

This study is aimed at providing the Board of Directors of the co-operative seed cleaning plants in Alberta with an appropriate pricing output, and reserve policy. Current pricing and reserve practices have made these plants dependent on government grants for renovations and construction. Several steps are followed in solving these problems.

The analysis of the application of co-operative principles by Alberta plants shows that they follow the accepted co-operative principles and business practices, with the exception of the one of providin education to their members. Their objective is to operate at their least average total costs.

The empirical results of the demand characteristics for Alberta plants show that their customers are not price-responsive. The Board of Directors can therefore increase prices, within the limits of the ones reviewed in this study, without changing the demand for seed cleaning services. The total cost and total variable cost functions are cubic functions of the plants' output. The plants' average total cost, marginal cost, and average variable cost curves, are U-shaped; their behaviour is therefore consistent with economic theory.

The empirical study of the pricing strategies for Alberta plants shows that they price at their long-run break-even point, which is also their economic capacity and optimum output of 475,000 bushels of seed. Their output is, however, less than their economic capacity, and their

average revenue is less than their average total cost. Their reserves are not cumulative, and are less than the required construction costs, because depreciation is based on historical data.

This study, therefore, recommends that calculations for depreciation should be adjusted to reflect increases in the plants' construction costs. Their reserves should be cumulative and earn interest. The prices should be adjusted to match the plants' adjusted average total costs, and throughput should be increased.

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CHAPTER I

INTRODUCTION

Objectives of Alberta Co-operative Seed Cleaning Plants

This research concerns Alberta service co-operative seed cleaning plants, hereinafter referred to as 'plants', which provide seed cleaning[1] facilities to the farmers in the Province of Alberta. They are owned, controlled and financed by shareholders who agree among themselves to share such risks and benefits that accrue to them in proportion to their patronage. Their objectives are:

1. to provide an efficient and inexpensive seed cleaning service to the co-operative shareholders;
2. to charge prices which enable the shareholders to recover the costs of cleaning seed without making profit; and
3. to follow the universally-accepted principles and practices of co-operation.

As they strive to achieve the above objectives, they also encounter some problems. These problems are discussed in the following section.

---

[1] Seed cleaning is the process whereby weed seeds, other crop seeds, stems, leaves, broken seed, and dirt are removed from seed, and seed is separated according to width and length.

Problem Analysis

In the day-to-day operation of these plants, diverse problems are encountered. These problems are:

1. inadequate reserves;
2. under-utilization of their capacity; and,
3. operating at a loss.

Some of these plants operate at a loss, as is shown in Tables B-14 and B-15[1]. For instance, 14% of the selected plants operated at a loss between 1973 and 1975; this was an improvement compared with 24% of the plants which operated at a loss in 1971. These calculations are shown in Table B-15. The possible cause of this problem seems to be inappropriate pricing.

According to the Field Crops Section of the Department of Agriculture, the plants' pricing policy is based on guesswork. As a result, prices are not adjusted according to changes in output, as is shown in Tables 1.1 and 1.2. Pricing issues are also related to the plants' reserve strategies.

The plants in Alberta are faced with the problem of escalating capital costs, as indicated in Table B-7. The cost of constructing one plant (which was stable and equal to $39,000 between 1948 and 1954) increased after 1955; it was $270,000 by 1975, and $350,000 at the beginning of 1977. However, calculations for depreciation are based on historical data. Consequently, the plants' reserves are not enough to meet their construction and renovation costs (see Tables B-12 and B-13).

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[1] Table numbers preceded by a letter indicate in which Appendix the Table is to be found.

Table 1.1

SERVICE CHARGES* FOR SHAREHOLDERS OF SELECTED** LARGE VOLUME† ALBERTA PLANTS (IN ¢/BUSHEL)

Code Number††	1970	1971	1972	1973	1974	1975
1	5.88	5.88	.56	6.54	6.70	6.77
2	7.00	7.00	6.67	6.21	5.60	6.49
3	7.00	7.00	8.11	7.54	8.40	9.02
4	6.50	6.50	6.67	7.09	6.40	7.22
5	8.00	8.00	7.63	7.09	12.00	10.83
6	7.00	7.00	6.67	7.09	8.00	8.66
7	7.00	7.00	7.63	7.09	8.00	8.66
8	7.00	7.00	9.54	8.87	9.60	8.65
9	6.00	6.00	9.54	8.87	8.80	9.38
10	5.50	5.50	5.72	7.09	8.00	8.66
11	6.00	6.00	7.63	7.98	8.80	8.66
12	7.00	7.00	7.63	7.98	8.80	10.10

*These service charges are the averages of several prices paid during different periods of the year, and are deflated with the consumer price indexes in Table B-5 (1971 = 100%).

**Selected plants, as hereinafter referred to, are the Alberta service co-operative seed cleaning plants randomly selected for the sample studied in this research.

†Large volume plants, as hereinafter referred to, are those plants which cleaned 300,000 or more bushels of seed in 1973.

††Plant code numbers (1 through 29) as used throughout this study are not the same as the numbers used in Maps 2.1 and 3.1.

Source: Questionnaire

Table 1.2

SERVICE CHARGES* FOR SHAREHOLDERS OF SELECTED SMALL VOLUME** ALBERTA PLANTS (IN ¢/BUSHEL)

Code Number	1970	1971	19,2	1973	1974	1975
13	7.00	7.00	8.11	7.54	7.60	8.30
14	8.00	8.00	7.63	7.98	8.00	7.94
15	7.00	7.00	6.91	6.43	6.60	6.31
16	7.50	7.50	8.58	8.87	8.80	10.10
17	6.00	6.00	6.20	7.32	6.60	7.40
18	7.50	8.50	9.06	9.31	8.40	11.19
19	6.00	6.00	6.67	6.21	7.20	8.66
20	6.67	6.67	7.31	6.80	7.73	6.98
21	8.00	8.00	8.58	8.87	8.80	9.38
22	7.30	7.30	6.96	7.76	7.00	7.76
23	7.00	7.00	6.67	7.09	7.20	7.22
24	6.00	6.00	6.67	6.21	6.66	6.01
25	7.00	7.00	6.67	6.21	6.66	7.58
26	6.00	6.00	5.72	5.32	8.00	7.22
27	7.00	7.00	6.67	7.09	7.20	6.49
28	7.00	7.00	7.63	7.09	8.00	7.22
29	7.00	7.00	7.63	7.09	8.00	8.66

*These service charges are the averages of several prices paid during different periods of the year, and are deflated with the consumer price indexes in Table B-5 (1971 = 100%).

**Small volume plants, as hereinafter referred to, are those plants which cleaned less than 300,000 bushels of seed in 1973.

Source: Questionnaire

For instance, in 1975 the individual selected plants' reserves ranged from $0 to $63,708. This amount was less than the required construction costs of $270,000 and renovation costs of approximately $100,000. The cause of the problem of low reserves seems to be both inflation and inadequate reserves policy. In addition to the problem of low reserves, the Government of Alberta has changed its policy regarding grants to the plants.

The policy of the Alberta Department of Agriculture and the municipalities up to December 1975 was to provide two-thirds of the money required for building and renovating plants (Tables B-7, B-8, and B-9). For example, the Department of Agriculture and the municipalities each contributed $15,000 out of the $45,000 required for constructing the Beiseker Seed Cleaning Plant in 1957. This policy was, however, changed to that of making the plants self-reliant after 1980. To enforce this policy, grants from the Department of Agriculture were limited to a maximum of $15,000 (Tables B-8 and B-9). This means that plants can expect no more than $30,000 from the municipalities and the Alberta Department of Agriculture. The Department of Agriculture believes that the financial problems of these plants can be solved by raising the seed cleaning service rates and by having an adequate reserves strategy.

The plants in Alberta are also faced with the problem of excess capacity. The plants' capacity can be defined in two ways--by the engineering definition and by the economic definition.

The engineering definition of capacity is given by Professor Smithies in the following way:

By full capacity output, I mean the output that the existing

> stock of equipment is intended to produce under normal working conditions with respect to hours of work, number of shifts, and so forth.[1]

Thus, the plant's full capacity is its technical capacity to produce a specified amount or quantity of services and/or goods in a given period of time, such as a day, a year, or its lifetime. The engineering full capacity of Alberta selected plants is 150 bushels per hour for plants with one indent[2], and 187 bushels per hour for plants with two indents. (Tables B-10 and B-11) This means that the plants with one indent should clean 264,000 bushels of seed, working eight hours a day for 220 days per annum[3]. The calculations are outlined in the footnote to Table B-10. The plants with two indents should clean 329,120 bushels of seed to operate at full capacity. However, as shown in Table 1.3, some of the plants clean less than 264,000 bushels of seed per annum. The percentage of selected plants which cleaned less than 264,000 bushels of seed per annum ranged from 59% in 1970 to 17% in 1975.

The economic definition of the plant's full capacity is its optimum plant output which, in turn, is defined as: "That output level associated with full competetive equilibrium."[4] In the case where an individual firm is facing an ill-defined or institutional market, capacity may be defined as that output level at which the firm's average cost

---

[1]Uganda Economics Association, *The Uganda Economic Journal*, Volume 1, Number 3 (Kampala: Makerere Institute of Social Research Publications, P.O. Box 16022, 1973), p.310.

[2]The indent cylinder separator is the machine used by the plants to separate seed according to its length.

[3]220 days are the possible working days, excluding Saturdays, Sundays, and the public holidays in Alberta.

[4]Uganda Economics Association, *op. cit.*, p.310.

Table 1.3

TOTAL NUMBER OF BUSHELS OF SEED CLEANED BY THE SELECTED ALBERTA PLANTS (1970-1975)

Code Number	1970	1971	1972	1973	1974	1975
			LARGE VOLUME PLANTS			
1	320,010	398,293	416,561	411,613	380,439	398,768
2	354,198	325,669	280,872	339,112	430,516	412,589
3	99,972	205,023	232,621	333,482	288,607	354,472
4	361,731	414,038	355,896	372,508	349,232	400,091
5	449,232	652,472	575,765	588,985	584,204	664,333
6	352,772	346,880	371,756	314,566	399,597	402,698
7	301,182	331,755	323,223	414,532	482,226	440,108
8	378,338	338,371	358,922	351,529	343,275	381,076
9	332,088	410,578	416,633	417,607	469,876	384,941
10	267,970	438,424	306,706	367,628	335,344	362,136
11	430,428	302,785	331,808	361,731	351,612	219,214
12	165,100	243,196	233,502	304,250	311,895	321,363
			SMALL VOLUME PLANTS			
13	380,217	264,984	195,908	181,847	270,821	305,000
14	289,516	217,670	219,190	269,365	296,280	313,864
15	210,908	216,098	283,522	289,395	300,529	352,929
16	248,853	242,255	215,259	255,098	285,128	259,120
17	232,223	242,246	242,738	255,423	300,655	269,697
18	307,586	217,975	276,974	263,957	313,468	264,786
19	248,606	276,085	262,398	255,607	286,925	363,988
20	236,756	294,425	273,851	288,361	301,813	305,703
21	187,908	167,310	152,983	179,939	201,895	210,000
22	203,121	215,161	215,548	205,519	298,294	329,625
23	308,181	203,277	163,845	174,371	203,408	229,466
24	282,017	284,319	256,789	266,841	293,086	304,464
25	262,932	278,402	246,266	261,245	268,521	261,539
26	228,294	249,612	206,644	232,939	211,374	288,114
27	210,519	235,525	213,107	254,424	263,906	292,658
28	204,712	218,312	187,199	176,475	205,383	250,055
29	197,530	266,571	286,368	291,582	332,609	360,877

Note: Percentage of selected large and small volume plants which cleaned less than 264,000 bushels of seed was as follows: 1970 - 59%; 1971 - 41%; 1972 - 52%; 1973 - 45%; 1974 - 17%; 1975 - 17%.

Source: Questionnaire, and Alberta Department of Agriculture, Field Crops Section, "Annual Summary of Grain Cleaned by Municipal Co[illegible]e Seed Cleaning Plants, 1970-73".

is at a minimum. By either definition, plants within an imperfect market structure likely operate at less than full capacity when they are producing where their marginal cost is equal to their marginal revenue.

Capacity under-utilization is caused partly by lack of storage facilities and partly by seasonal demand patterns which might, in fact, be an indirect cause of the low net earnings. Most of the farmers prefer to have their seed cleaned in late winter and spring. Consequently, seed cleaning plants' capacities are under-utilized during summer and fall. Overtime operations during peak seasons, and unused capacity at other times, contribute to higher operating costs and management problems. The quality of cleaned seed inevitably goes down during the spring rush. The public policy question becomes that of determining the plants' reserve, output and pricing policies.

The purpose of this study is to develop a pricing framework based on costs, reserve requirements, and the demand characteristics of seed cleaning services.

Organization of the Study

Chapter I identifies and analyzes the plants' problems, and proposes methods for solving them. This study is based on the background information presented in Chapter II about the history of the plants, their organizational structure, nature of business, and sources and applications of finance. The methods used in this study are presented in Chapter III. The first part of Chapter IV reviews internationally-accepted co-operative principles and business practices; the empirical results from a test of the applicability of these principles and practices to selected Alberta seed cleaning plants form the

second part of Chapter IV. Chapter V analyzes and interprets empirical results of the pricing and output policies based on the plants's costs, reserve requirements, and demand characteristics of the seed cleaning service. Conclusions based on the analyses and economic interpretations in Chapters IV and V are then used, in Chapter VI, to make recommendations for an appropriate economic output and pricing policy for co-operative seed cleaning plants in Alberta.

CHAPTER II

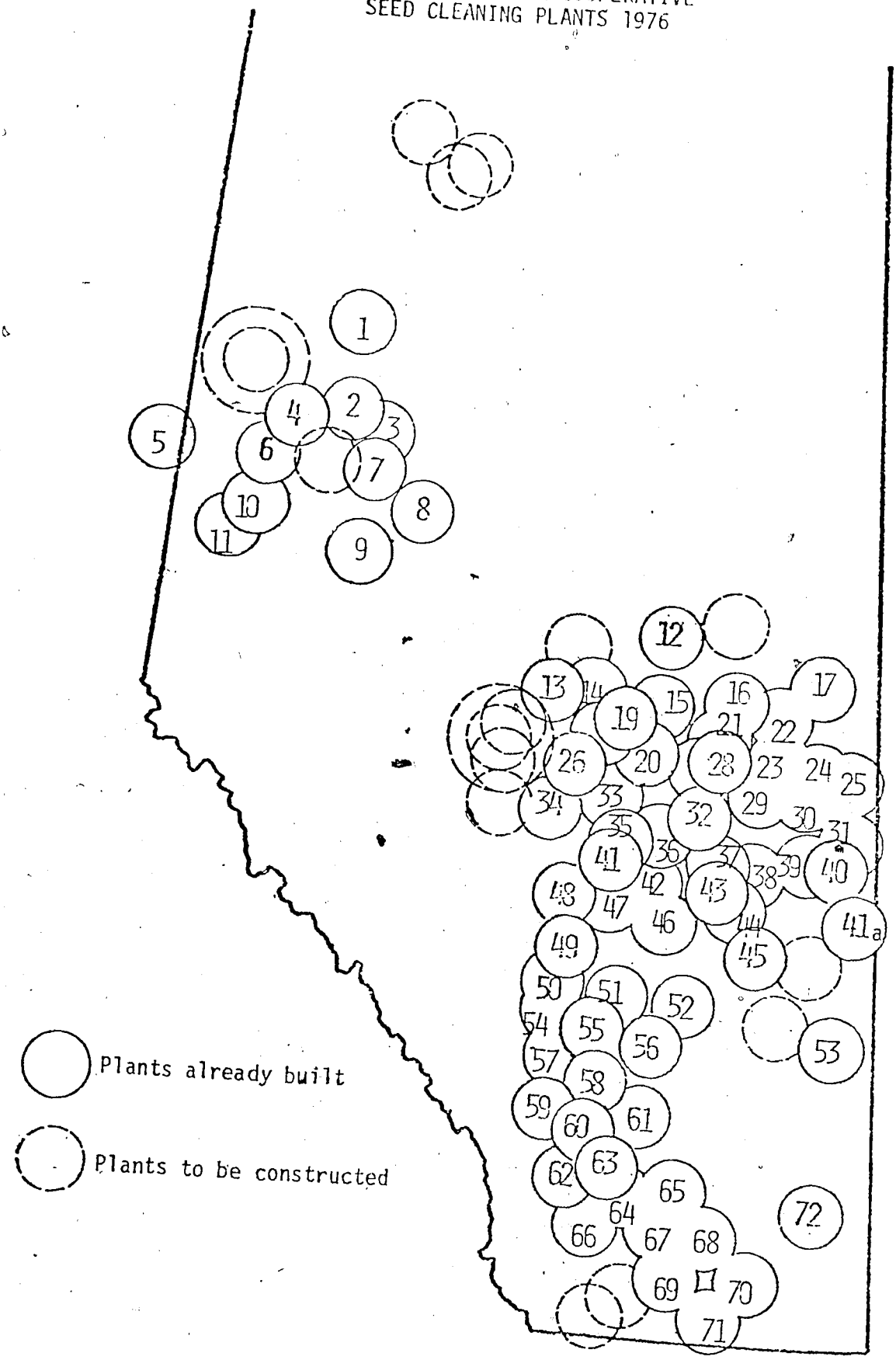
ALBERTA MUNICIPAL CO-OPERATIVE SEED CLEANING PLANTS

Background

Before the introduction of seed cleaning plants in Alberta, farmers were faced with the problems of the spread of noxious weeds and lack of adequate seed cleaning facilities. The Department of Agriculture introduced portable seed cleaning equipment for farmer groups in the 1930's. The late 1940's saw the introduction of the stationary custom cleaning plant when portable equipment was assembled in the vacant army drill hall at Camrose. In co-operation with the farmer shareholders' co-operatives and the municipalities, the Department of Agriculture embarked on the task of constructing large wood crib stationary plants. The initial machinery consisted of four cylinder indent machines, and some plants included a buffer machine. The holding capacity of these plants was about 10,000 bushels, and throughput averaged one hundred bushels per hour. Dockage removal averaged 25%, and cleaning charges were 3¢ to 4¢ per bushel on incoming weight. To date, Alberta has seventy-five co-operative seed cleaning plants strategically located throughout the province. (Map 2.1) The progress made in the construction of seed cleaning and treating facilities in Alberta from 1948 to 1975 is shown in Table 2.1. Four plants were built in the 1940's, thirty plants in the 1950's, thirty-four in the 1960's, seven plants

MAP 2.1

ALBERTA MUNICIPAL COOPERATIVE
SEED CLEANING PLANTS 1976



KEY TO MAP 2.1

NAMES OF ALBERTA MUNICIPAL CO-OPERATIVE SEED CLEANING PLANTS (1975)

1. Manning
2. Grimshaw
3. Nampa
4. Fairview
5. Dawson Creek
6. Rycroft
7. Falher
8. High Prairie
9. Valleyview
10. Sexsmith
11. Wembley
12. Boyle
13. Barrhead
14. Westlock
15. Radway
16. Vilna
17. Bonnyville
18. Morinville
19. Gibbons
20. Josephburg
21. Willingdon
22. St. Paul
23. Myrnam
24. Clandonald
25. Marwayne
26. Stony Plain
27. Mundare
28. Vegreville
29. Innisfree
30. Vermilion
31. Paradise Valley
32. Holden
33. Leduc
34. Warburg
35. Wetaskiwin
36. Camrose
37. Strome
38. Lougheed
39. Wainwright
40. Edgerton
41a. Provost
41. Ponoka
42. Bashaw
43. Forestburg
44. Alliance
45. Coronation
46. Stettler
47. Clive
48. Bentley
49. Innisfail
50. Olds
51. Three Hills
52. Delia (Starland)
53. Oyen
54. Carstairs
55. Beiseker
56. Rosebud
57. Balzac
58. Strathmore
59. Okotoks
60. Blackie
61. Queenstown
62. Nanton
63. Vulcan
64. Carmangay
65. Enchant
66. Granum
67. Coaldale
68. Taber (Fincastle)
69. Craddock
70. Foremost
71. Milk River
72. Medicine Hat

Table 2.1

NAMES OF ALBERTA CO-OPERATIVE SEED CLEANING PLANTS AND YEARS WHEN THEY WERE BUILT

Period	Number	Plant Names and Years Built
1940s	4	1948: Camrose 1949: Morinville, Westlock, Wetaskiwin
1950s	30	1951: Marwayne 1952: Mundare, Vegreville 1953: Rosebud, Strome, Vermilion 1954: [illegible]gheed, Myrnam, Paradise Valley, Willingdon 1955: Leduc, Stony Plain 1956: Balzac, Blackie 1957: Alliance, Beiseker, Fincastle, St. Paul, Strathmore 1958: Innisfree, Radway, Sexsmith, Three Hills, Vulcan, Wainwright 1959: Bashaw, Carmangay, Innisfail, Nanton, Okotoks
1960s	34	1960: Barrhead, Falher, Holden, Provost, Queenstown, Rycroft, Stettler 1961: Bentley, Carstairs, Craddock 1962: Delia, Fairview, Grimshaw, Ponoka 1963: Gibbons, Granum 1964: Coronation, Dawson Creek, Medicine Hat, Warburg 1965: Olds, Oyen 1966: Edgerton, Forestburg, High Prairie, Nampa 1967: Boyle, Milk River 1968: Clive, Coaldale, Enchant 1969: Manning, Vilna
1970s	7	1970: Lisburn 1971: Bonnyville, Clandonald 1972: Valleyview 1974: Foremost, Josephburg, Wembley 1975: Hussar
TOTAL	75	

Source: Department of Agriculture: Seed Cleaning Plants Analysis. 1969-1975.

were constructed between 1970 and 1975, and there are plans to build ten more plants.

There are several seed cleaning markets[1] which coincide with the location of the plants in Alberta as shown on Map 2.1. The plants' locations are separated by a distance of approximately fifty miles, with each plant serving a market within a twenty-five mile radius.

The plants in each market sell their seed cleaning services to many buyers who, in 1975, ranged from 150 to 550 shareholders. The shareholding customers account for 95% of the total number of buyers in each market. The number of sellers found in each market varies. The markets which are far removed from other seed cleaning plants have one seller (one plant) of seed cleaning services. Others overlap, and farmers in the periphery of these markets have a choice of several plants where they can have their seed cleaned.

The seed cleaning service is differentiated according to quality, distance, and the managers' efficiency, reflected in lower prices and less time taken for cleaning seed. There is freedom for the buyers and sellers to enter or leave the market. However, this freedom is limited by the high construction costs and volume of seed required to justify the introduction of a new plant or the abandonment of one already in operation. All plants determine the prices at which the seed cleaning service should be sold. Labour is mobile, while plants are immobile.

---

[1] "A market may be loosely defined as an area or setting within which producers and consumers are in communication with one another, where supply and demand conditions operate, and the title to goods is transferred. The actual movement of goods in space or time is usually but not necessarily involved." Raymond G. Bressler, Jr. and Richard A. King, *Markets, Prices and Interregional Trade* (New York: John Wiley and Sons, Inc., 1970), pp. 74,75.

In summary, Alberta plants have many buyers of a differentiated seed cleaning service. Each plant determines its seed cleaning service prices, and entry and exit is limited by the heavy construction costs involved, and seed availability. The plants, therefore, operate under conditions of imperfect competition. Their operation is based on the following organizational structure.

Organization

The day-to-day business of the plants is carried out by the paid management responsible to an elected Board of Directors. (Figure 2.1) The Board of Directors, in turn, is accountable to the shareholders of the co-operative seed cleaning plant. Alberta co-operative plants are affiliated with a central board, called "The Association of Alberta Co-Op Seed Cleaning Plants Limited." Each plant has nine members on the Board of Directors, six of whom are elected by members, two are appointed by the municipality on the recommendation of the Service Board, and one is appointed by the Minister of Agriculture in the Province of Alberta. The Field Crops Commissioner is an ex-officio member of the Board of Directors[1]. The term of office for the members of the Board of Directors is three years, with the exception of the first elections, when two directors with the highest votes serve for a period of three years; the third and fourth, respectively, serve for two years; the fifth and sixth members remain in office for one year. This system was designed to ensure continuity in the running of the plant's affairs. A substantial number

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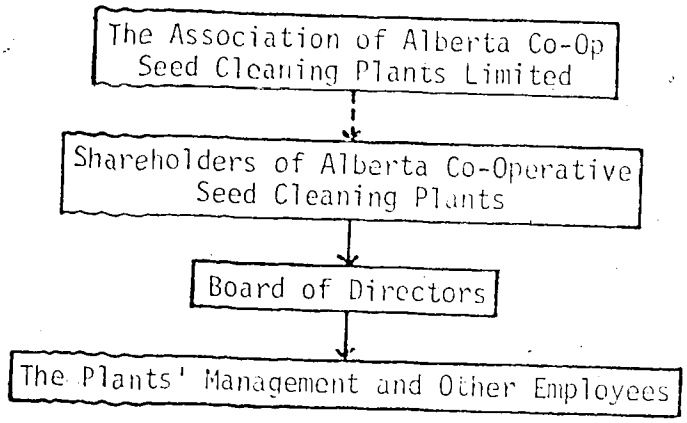
[1]From Alberta Department of Agriculture, *Suggested Supplemental By-Laws for Seed Cleaning Plants Co-operatives Incorporated Under the Provisions of the Co-operative Association Act* (Edmonton: Department of Agriculture), p.2.

of farmers in Alberta are members of the co-operative seed cleaning plants.

Figure 2.1

HIERARCHY



Legend:

⟶ The direction of the arrow shows the flow of power. For example, the Board of Directors is responsible to the shareholders.

– – – → Relationship does not involve power. For example, the Association of Alberta Co-Op Seed Cleaning Plants Limited does not control plants.

The total number of Alberta plants' shareholders was 20,431 members in 1973. The number of shareholders of each plant varies, ranging from 150 to 1,300 in 1977[1]. However, the average number of shareholders for the seven selected large plants was 404, and that of the eight selected small plants was 376 members. (Tables 2.2 and 2.3) The plants in Alberta hold one annual general meeting, which is usually not well attended. The average attendance at general meetings for the

[1]From Alberta Department of Agriculture, *Seed Cleaning Plants Annual Reports* (1970-77).

Table 2.2

NUMBER OF EMPLOYEES, SHAREHOLDERS, MEETINGS, ATTENDANCE, AND DAYS OF OPERATION PER ANNUM FOR SELECTED LARGE VOLUME ALBERTA CO-OPERATIVE SEED CLEANING PLANTS

Code Number	Days of Operation Per Annum	Permanent Employees	Seasonal Employees	Share-holders	General Meetings	Attendance at General Meetings
1	232	2	2	705	1	19
2	270	2	1	--*	1	--
3	210	1	1	463	--	--
4	--	2	1	--	1	15
5	280	3	3	317	1	30
6	--	2	1	363	1	10
7	--	2	1	350	1	20
8	--	2	2	--	1	--
9	--	2	2	600	2	40
10	--	2	1	--	1	12
11	--	2	0	32	--	20
12	--	--	--	--	--	--
TOTAL	992	22	15	2,830	9	166
Average**	248	2	1.46	404.29	1	20.74

*(--) indicates required data not supplied.

**Average is column total divided by number of plants in the respective column which supplied data.

Source: Questionnaire

Table 2.3

NUMBER OF EMPLOYEES, SHAREHOLDERS, MEETINGS, ATTENDANCE, AND DAYS OF OPERATION PER ANNUM FOR SELECTED SMALL VOLUME ALBERTA CO-OPERATIVE SEED CLEANING PLANTS

Code Number	Days of Operation Per Annum	Permanent Employees	Seasonal Employees	Share-holders	General Meetings	Attendance at General Meetings
13	220	1	1	400	1	20
14	--*	2	1	--	1	--
15	--	2	1	340	1	20
16	250	2	1	--	1	15
17	--	2	0	--	1	15
18	235	1	2	337	1	10
19	260	2	2	470	1	50
20	--	2	1	--	--	20
21	200	1	0	169	1	15
22	225	2	2	380	1	30
23	--	1	1	--	1	8
24	280	3	1	--	1	15
25	--	1	1	300	1	17
26	240	1	1	417	1	40
TOTAL	1,910	23	15	2,814	13	275
Average**	238.75	1-9/14	1	351.75	1	21.15
Sample Average	242	1.8 (2)	1	376	1	20.9 (21)

*(--) indicates required data not supplied

**Average is column total divided by number of plants in the respective column which supplied data.

Source: Questionnaire

plants examined in this study was twenty-one members.

Employment opportunities offered by these co-operatives are low. The average number of employees, for the sample used in this study, was one seasonal and two permanent employees.

Seed Cleaning

As already defined, seed cleaning is the process whereby weed seeds, other crop seeds, stems, leaves, broken seed, and dirt, are removed from seed to produce a high quality product for planting. The plants in Alberta use three machines to accomplish this work: (1) the air and screen machine; (2) the indent cylinder separator; and (3) the precision grader.

The air and screen machine has an air leg which removes pieces of pod hulls, dust and other high chaffy material. The scalper screen removes long straw and large bulky trash. The top screen in each shoe scalps off large material, and the bottom screen sifts out dirt, splits, broken or undersized kernels, and the small trash. Seed is subjected to a second air separation before it is discharged. The main function of the air and screen machine is, therefore, to separate light material and small seed from the rest of the seed.

The indent cylinder separator[1] is used to separate seed according to length. The precision grader[2] separates seed according to width.

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[1]"The indent cylinder separator is a rotating, almost horizontal cylinder with a movable, horizontal separating trough mounted inside it. Thousands of half-round recesses or indents line the inside surface of the cylinder. As the cylinder revolves, it creates centrifugal force which helps to hold seed in the indent. Short seeds are held in the indent until the cylinder turns to the point where the indent is inverted enough for gravity to cause the seed to fall out of the indent into an adjustable trough." Krishan

Sources of Finance and Reserve Practices

The biggest source of finance for the plants is the provincial and municipal grants which accounted for two-thirds of the plants' construction and renovation costs up to December 25, 1975, as is explained in Tables B-7, B-8, and B-9. This source, however, is now restricted to $15,000 each from the Department of Agriculture and the municipality during the period 1975 to 1980, after which the plants are expected to be self-sufficient. The average amount of grants to the ten selected plants in Table 2.4 was $5,848 for the period 1972 to 1975.

The second source of finance for Alberta plants is that of depreciation. For the ten selected plants in Table 2.4, it accounted for an average of $3,768 between 1972 and 1975.

Net earnings are another source of finance for the plants. As indicated in Table 2.4, the ten plants averaged $2,308 between 1972 and 1975. The rest of the sources of finance include: reduction of prior years' dividends, income tax refunds, interest from savings certificates, decrease in inventory, increase in accounts payable, and decrease in deposits on shares.

Kumar Chawla, *Evaluation of Seed Cleaning Machines* (Edmonton: Engineering Field Services Branch, Alberta Department of Agriculture, 1977), p.6.

[2]"The grader is a size separator that classifies seed either by width or thickness. It employs cylindrical screens or "shells" that are mounted horizontally and have slotted or round perforations. In operation, the seed lot to be separated is fed into one end of the rotating shell where it tumbles and migrates towards the tail end. Separation is made by the perforation located in the bottom of the grooves. The rim of the grooves turns the seed up on edge so that its side or thickness dimension is presented to the perforation. Thin seed falls through, while thick seed is rejected. The No. 6 Carter precision grader is designed to use six perforated cylinders for sizing material." Chawla, *Op. Cit.*, p.11.

Table 2.4

FUNDS FLOW ANALYSIS FOR TEN SELECTED ALBERTA PLANTS, 1972 - 1975

PART I: SOURCES OF FUNDS

Plant	Year	Net Earnings for the Year	Depreciation	Sales of Shares	Grants Received	Income Tax	Reduction of Prior Years' Dividends	Savings Certificates	Decrease in Inventory	Sale of Fixed Assets	Increase/ Decrease in Accts. Payable	Refund on Deposit	Decrease in Deposits on Shares	Decrease in Accounts Receivable	Sale of Term Deposits	Interest	Maturity of Investment	Term Loans	Total
Beiseker	1975	1,823	1,986	550	3,655	--	--	--	--	--	--	--	--	--	--	--	--	--	8,015
	1974	9,695	2,377	150	--	--	--	--	--	--	--	--	--	--	--	--	--	--	12,222
	1973	6,440	2,795	100	--	--	--	--	--	--	--	--	--	--	--	--	--	--	9,335
	1972	4,414	2,099	200	--	--	--	--	--	--	--	--	--	--	--	--	--	--	6,713
Edgerton	1975	(3,242)	4,724	--	--	--	366	--	--	--	--	--	--	--	--	--	--	--	1,848
	1974	2,456	5,587	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	8,043
	1973	--	5,137	200	--	--	33	--	--	--	--	--	--	--	--	--	--	--	5,370
	1972	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Bentley	1975	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	1974	4,028	3,336	950	--	--	--	--	904	--	(2,096)	--	(292)	--	--	--	--	--	11,187
	1973	(1,539)	--	395	--	--	--	--	--	--	2,929	--	--	--	--	--	--	--	1,785
	1972	--	--	600	--	--	--	--	516	--	230	--	(8)	--	--	--	--	--	1,238
Gibbons	1975	(8,912)	4,325	--	6,450	--	--	--	--	--	--	--	--	--	--	--	--	--	1,863
	1974	1,620	3,648	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	5,380
	1973	1,014	3,648	450	--	--	--	--	--	--	--	--	112	--	--	--	--	--	5,461
	1972	--	--	--	--	--	--	--	--	--	--	--	349	--	--	--	--	--	--
Innisfail	1975	10,629	3,224	500	6,261	--	1,000	--	1,000	--	--	--	--	--	--	--	--	--	22,614
	1974	6,752	2,679	900	--	--	1,000	--	--	--	--	--	--	--	--	--	--	--	11,446
	1973	1,908	2,894	600	--	--	1,018	--	--	--	--	--	--	115	--	--	--	--	6,635
	1972	3,426	3,127	700	--	--	938	--	--	--	20	--	--	190	--	--	--	--	8,461
Warburg	1975	222	5,390	240	3,952	--	--	--	1,200	--	--	--	184	270	--	--	--	--	12,303
	1974	1	4,340	840	--	--	--	--	35	--	--	--	--	--	--	--	--	--	5,219
	1973	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	1972	(2,740)	3,231	200	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

Table 2.4

PART I: SOURCES OF FUNDS (continued)

Plant	Year	Net Earnings for the Year	Depreciation	Sales of Shares	Grants Received	Income Tax	Reduction of Prior Years' Dividends	Savings Certificates	Decrease in Inventory	Sale of Fixed Assets	Increase/ Decrease in Accts. Payable	Refund on Deposit	Decrease in Deposits on Shares	Decrease in Accounts Receivable	Sale of Term Deposits	Interest	Maturity of Investment	Term Loans	Total
Grimshaw	1975	4,419	4,898	600	3,600	--	--	--	--	--	--	--	--	--	--	--	--	--	13,517
	1974	4,419	4,898	600	3,600	--	--	--	--	--	--	--	--	--	--	--	--	--	13,517
	1973	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	1972	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Medicine Hat	1975	3,168	--	1,035	9,725	28	--	7,000	--	--	--	--	--	--	--	--	--	--	--
	1974	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	1973	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	1972	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Fairview	1975	1,063	4,222	850	4,140	--	--	--	--	--	--	--	--	--	--	--	--	--	10,275
	1974	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	1973	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	1972	277	3,033	400	--	--	--	--	--	--	--	--	--	--	--	974	5,000	--	9,585
Strathmore	1975	(4,162)	7,837	16,750	--	--	--	--	--	21,633	--	120	--	--	--	--	--	--	40,299
	1974	6,862	2,415	--	--	--	--	--	--	--	--	--	--	--	8,000	--	--	--	17,277
	1973	6,690	2,847	19,000	11,250	--	--	--	--	2,700	--	--	--	--	--	--	--	16,000	58,487
	1972	1,592	3,285	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	4,877
TOTAL		63,325	97,982	46,810	56,633	28	4,355	7,000	3,655	24,333	1,083	120	345	575	8,000	974	5,000	16,000	332,715
No. of Observations		27	26	23	9	1	6	1	5	2	4	1	5	3	1	1	1	1	29
AVERAGE		2,308	3,768	2,035	5,848	28	726	7,000	731	12,167	271	120	69	192	8,000	974	5,000	16,000	11,473

Table 2.4 (continued)

PART II: APPLICATION OF FUNDS

Plant	Year	Redemption of Shares	Purchase of Term Deposits	Purchase of Fixed Assets	Taxes	Tax Penalties	Payment of Dividends	Construction Bank Account	Deferred Charges	Increase in Inventory	Increase in Prepaid Expenses	Increase in Accounts Receivable	Total	Change in Funds	Funds at the Beginning of the Year	Funds at the End of the Year
Beiseker	1975	100	7,915	--	--	184	--	--	--	--	--	--	8,199	(184)	--	--
	1974	150	11,843	228	--	94	--	--	--	--	--	--	12,217	843	--	--
	1973	450	3,744	5,056	--	54	--	--	--	--	--	--	9,335	3,744	--	--
	1972	200	5,861	633	--	19	--	--	--	--	--	--	6,713	5,861	--	--
Edgerton	1975	450	--	--	--	--	246	--	--	119	--	--	815	1,033	29,570	30,603
	1974	450	--	--	--	--	125	--	--	--	--	--	575	7,470	22,100	29,570
	1973	--	--	2,385	--	--	--	--	--	--	--	--	2,632	2,738	19,362	22,100
	1972	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Bentley	1975	--	--	--	--	--	--	--	--	--	4	--	354	10,823	3,774	14,597
	1974	350	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	1973	100	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	1972	500	--	300	--	234	--	--	--	915	--	1,522	2,537	(752)	4,526	3,774
Gibbons	1975	100	--	6,761	--	--	--	--	--	--	--	80	1,114	224	4,302	4,526
	1974	50	--	--	--	--	--	--	--	--	2	--	6,863	(5,000)	--	--
	1973	--	--	--	--	--	--	--	--	--	25	--	75	5,3[illegible]	--	--
	1972	--	--	--	--	--	--	--	--	--	7	--	7	5,454	--	--
Innisfail	1975	650	--	--	--	9,406	195	--	--	--	--	--	--	--	--	--
	1974	350	--	--	--	--	88	--	--	--	--	--	10,251	12,363	41,575	53,938
	1973	400	--	--	--	--	73	--	--	--	--	--	438	11,[illegible]	30,967	41,575
	1972	900	--	600	--	--	135	--	--	--	--	--	473	6,157	24,410	30,567
Warburg	1975	--	--	8,334	--	--	1,000	--	--	--	--	--	2,286	6,175	18,235	24,410
	1974	550	--	1,046	--	--	3,000	--	--	--	--	--	9,334	369	15,533	16,502
	1973	--	--	--	--	--	--	--	--	--	--	--	4,[illegible]	1,172	14,361	15,533
	1972	--	10,000	1,938	--	--	--	--	--	--	--	--	--	--	--	--
													11,338	(11,247)	16,527	5,280

Table 2.4

PART II: APPLICATION OF FUNDS (continued)

Plant	Year	Redemption of Shares	Purchase of Term Deposits	Purchase of Fixed Assets	Taxes	Tax Penalties	Payment of Dividends	Construction Bank Account	Deferred Charges	Increase in Inventory	Increase in Prepaid Expenses	Increase in Accounts Receivable	Total	Change in Funds	Funds at the Beginning of the Year	Funds at the End of the Year
Grimshaw	1975	850	--	4,500	--	--	--	--	--	149	--	--	5,499	8,018	22,102	30,120
	1974	850	--	4,500	--	--	--	--	--	149	--	--	5,499	8,018	22,102	30,120
	1973	--	--		--	--	--	--	--	--	--	--	--	--	--	--
	1972	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Medicine Hat	1975	589	--	9,936	14	--	--	--	--	--	--	--	10,539	10,417	--	--
	1974	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	1973	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	1972	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Fairview	1975	400	--	9,196	--	--	--	--	--	--	--	--	9,596	679	23,583	24,262
	1974	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	1973	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
	1972	550	--	120	--	--	--	--	--	--	--	--	670	8,915	17,459	26,374
Strathmore	1975	--	--	63,748	--	--	--	--	--	--	--	--	63,748	(23,443)	--	--
	1974	--	--	45	--	--	--	2,402	11,142	--	--	--	13,589	3,688	29,260	32,948
	1973	--	61,700	381	--	--	--	477	--	--	--	--	62,558	(4,071)	33,331	29,260
	1972	50	--	50	--	--	--	--	--	--	--	--	50	4,927	--	--
TOTAL		9,039	101,063	119,757	14	9,991	4,862	2,879	11,142	1,332	38	1,602	261,990	124,864	332,679	466,069
No. of Observations		23	6	20	1	6	8	2	1	4	4	2	29	29	19	19
AVERAGE		393	16,843	5,987	14	1,665	607	1,439	11,142	333	9.5	801	9,033	4,303	29,667	24,530

Note: Figures in parentheses represent a negative decrease.
(--) indicates data not available.

Source: Plants' Annual Financial Reports.

The funds are mainly spent on the purchase of term deposits and fixed assets. The average amount of money spent on buying term deposits, as shown in Table 2.4, was $16,843 between 1972 and 1975 for the ten selected plants; an average of $5,987 was spent on buying fixed assets; and the average amount of money spent on the payment of redemption of shares and taxes was $393 and $607 respectively.

In summary, there are four important sources of plant reserves: (1) grants; (2) sales of shares; (3) depreciation; and (4) net earnings. Their total must be increased to fill the gap left after the termination of the government grants. Furthermore, reserves should be cumulative over time. However, the figures in Tables 2.4, B-12 and B-13, show that the plants' reserves have not been accumulating over recent years.

Reserves constitute the financial basis for construction and renovation of plants in the absence of government grants. With limited opportunity to sell shares, reserves must be financed from depreciation and net earnings. Depreciation may be adjusted to reflect the increasing construction costs, and seed cleaning prices must be increased to match the increase in depreciation and to expand net earnings.

CHAPTER III

METHODOLOGY

Introduction

Chapter I of this enquiry identifies and analyzes the problems of seed cleaning plants in Alberta as: (1) operating at a loss; (2) under-utilization of their capacity; and (3) inadequate reserves. The possible causes of these problems are: inappropriate pricing (service charges) and output and reserve policies. The following data are required for formulation of the appropriate policies for the plants in Alberta: (1) the plants' costs, i.e. total, fixed, variable, average total, and marginal; (2) the plants' revenue, i.e. total, average, and marginal; (3) service charges; (4) throughput; (5) the plants' capacity; and (6) the application of co-operative principles and business practices. A sample was selected to facilitate the collection of these data.

Selection of the Sample

A stratified random sample of twenty-nine Alberta plants was selected because a properly sampled population gives reliable and unbiased estimates of population parameters at a fraction of the cost of

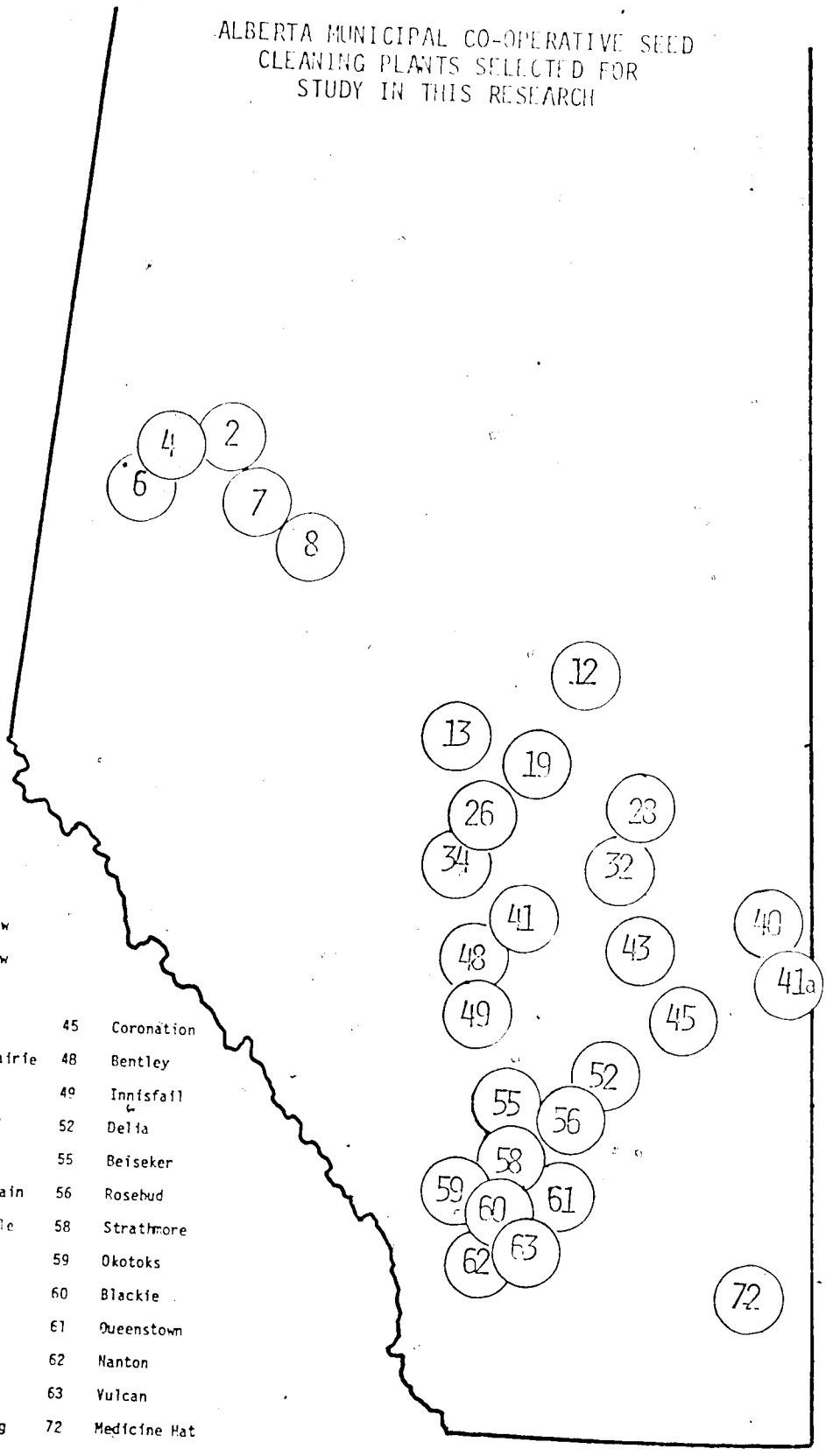
full enumeration. The identification and location of each of the twenty-nine plants is indicated on Map 3.1. Twenty-nine plants were considered to be a good sample size, because they represent 50% of the fifty-eight plants that had data for at least five years. Throughput was used in stratification because it was related to the plants' capacity utilization problem, and it is the independent variable of the functions used in this analysis. The fifty-eight plants were first divided into two sections according to throughput, and then were arranged alphabetically in each stratum. The plants which cleaned 300,000 or more bushels of seed in 1973 were grouped together, while the second group was composed of those which cleaned less than 300,000 bushels of seed. Throughput of 300,000 bushels of seed was chosen because it was the mid-figure of the seed cleaning plants' throughput for 1973. The purpose of stratifying was to find the differences and/or similarities between the large and small volume plants.

In a simple random sample, each element has equal probability of being chosen. Assuming the population size is N, the probability of selecting one element is 1/N. Cards or slips of paper may be used in this method, and are normally numbered according to the number of elements there are in the population. They are put into a container, mixed thoroughly, and then picked one at a time until the number of cards or slips of paper is equal to the sample size required. Alternatively, a table of random numbers can be used in selecting a simple random sample.

A table of random digits consists of a series of the digits 0, 1, . . ., 9, each digit occurring with the same relative frequency, but in a manner deemed to be random. The population is numbered serially, and an arbitrary point on the table of random digits is chosen as

Map 3.1

ALBERTA MUNICIPAL CO-OPERATIVE SEED CLEANING PLANTS SELECTED FOR STUDY IN THIS RESEARCH



2	Grimshaw		
4	Fairview		
6	Rycroft		
7	Falher	45	Coronation
8	High Prairie	48	Bentley
12	Boyle	49	Innisfail
13	Barrhead	52	Delia
19	Gibbons	55	Beiseker
26	Stony Plain	56	Rosebud
28	Vegreville	58	Strathmore
32	Holden	59	Okotoks
34	Warburg	60	Blackie
40	Edgerton	61	Queenstown
41(a)	Provost	62	Nanton
41	Ponoka	63	Vulcan
43	Forestburg	72	Medicine Hat

the starting point. A consistent path on the table of random digits is followed until the required sample size is selected. The use of a simple random sample facilitates the use of probability models of distribution. Conclusions are made from the results of the application of probability models.

A questionnaire was formulated and tested on two plants to find out how much time it was going to take to answer all the questions, and to test for their clarity. A final questionnaire was then designed, based on the results of the test of the first one. The plants included in the sample received this questionnaire before they were visited, giving the managers enough time to work out some of the required data, such as the costs of production, revenue and service charges for the years 1970 to 1975. These plants were later visited to collect the questionnaires and to carry out on-the-spot interviews, which included questions raised by the managers. Secondary data, collected from the annual financial reports of the plants, were also used. The following procedure was used in this research.

Application of Co-operative Principles and Business Practices by Alberta Plants

This research reviews the development of co-operative principles and business practices, and finds out whether the plants in Alberta apply them. Ten questions were used in testing the application of these principles and practices by the selected plants in Alberta. The method of scoring was 10% where co-operative principles and/or business practices were applied, and 0% if they were not followed. The conclusions drawn from this analysis show the pricing objectives of the plants in Alberta,

and are used in determining the plants' output, price, and re es policy.

The Models Used in This Study

The pricing and output policies for co-operative plants are derived from calculations of marginal cost, marginal revenue, price, average revenue (demand), average total cost, and the average variable cost. These calculations are, in turn, derived from their respective total costs, total iable cost, and demand functions.

The total cost model used in this study was defined as:

$$TC = \alpha_o + \alpha_1 Q + \alpha_2 Q^2 + \alpha_3 Q^3 + U$$

where Q = bushels of seed cleaned

TC = total cost in dollars

U = the error term, and

α = parameter estimates meet Chiang's[1] restrictions

$$MC = TC^1 = \alpha_1 + 2\alpha_2 Q + 3\alpha_3 Q^2$$

$$ATC = \frac{TC}{Q} = \alpha_o Q^{-1} + \alpha_1^{\circ} + \alpha_2 Q + \alpha_3 Q^2$$

The total variable cost model used in this research was as follows:

$$TVC = \gamma_o + \gamma_1 Q + \gamma_2 Q^2 + \gamma_3 Q^3 + U$$

where TVC = total variable costs

---

[1] "In sum, therefore, the coefficients of the total cost function should be as follows: a,c,d >0; b <0; b^2 <3ac." Alpha C. Chiang, *Fundamental Methods of Mathematical Economics*, Second Edition (New York: McGraw-Hill Book Company, 1974), pp.264,265.

γ_o = intercept

U = error term

The average variable cost function is therefore as follows:

$$AVC = \alpha_o Q^{-1} + \alpha_1 + \alpha_2 Q + \alpha_3 Q^2$$

The demand model used in this research was:

$$P = \beta_o + \beta_1 Q + U$$

where P = price

Q = bushels of seed cleaned

U = error term

The marginal revenue function is therefore equal to:

$$PQ = \beta_o + 2\beta_1 Q$$

where $\beta_1 < 0$ under imperfect competition

or $\beta_1 = 0$ under perfect competion. Average revenue is equal to demand.

The ordinary least squares estimating technique was chosen because of the following advantages:

1. the ordinary least squares method does not require many observations, and its computational procedure is simple; and

2. parameter estimates obtained by the ordinary least squares estimate without bias are the true parameters of the population. This study was based on the ordinary least squares assumptions outlined by Koutsoyiannis.[1]

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[1] "1. U_i, the error term, is a random variable representing a linear combination of omitted minor variables.
2. $E(U_i) = 0$ for all i. This means that the mean of U_i is zero.

Hypotheses

The significance of parameter estimates is tested by using the t-statistic at the 95% level of significance. The null hypothesis is that the $\hat{\alpha}$-, $\hat{\gamma}$-, and $\hat{\beta}$-coefficients of the explanatory variables of the total cost, variable costs, and the demand models are not significantly different from zero.

The null hypotheses are:

$H_0 : \hat{\beta}_i = 0$ for the demand function,

$H_0 : \hat{\gamma}_i = 0$ for the variable cost function, and

$H_0 : \hat{\alpha}_i = 0$ for the total cost function.

The alternative hypotheses are:

$H_1 : \hat{\beta}_i \neq 0$

$H_1 : \hat{\alpha}_i \neq 0$

$H_1 : \hat{\gamma}_i \neq 0$

meaning that the parameter estimates are significantly different from zero. The importance of this test is to find out if the parameter

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3. There is constant variance of U in each period.
4. U_i has a normal distribution.
5. $E(U_i,U_j) = 0$ for all i not equal to j. This means that the values of U_i are independent of each other.
6. The error term is independent of the explanatory variables in the total cost, variable costs, and demand models.
7. The independent variables are not perfectly linearly correlated.
8. The explanatory variables are measured without error.
9. The relationship is correctly specified." A. Koutsoyiannis, *Theory of Econometrics: An Introductory Exposition of Econometric Methods* (London: The Macmillan Press Ltd., 1973), pp. 54-57.

estimates of the independent variables could be relied upon in explaining the variability of the dependent variable which was total cost, price, and variable costs in this study. If the paramter estimate of the explanatory variable is significant, it means that that independent variable cannot be ignored when considering factors which are likely to influence the total costs, total variable costs, and price.

The multiple coefficient of determination is tested with the F-statistic at the 95% level of confidence. The null hypothesis is $H_0 : R^2 = 0$, meaning that the explanatory variables are not significant in explaining the variability of the dependent variable. The alternative hypothesis is $H_1 : R^2 \neq 0$, meaning that the independent variables are significant in explaining the variability of the dependent variable.

The covariances from the computer printout of the explanatory variables are used to test for the presence of multicollinearity. The presence of multicollinearity means that one of the assumptions of the ordinary least squares method has been violated. The parameters are indeterminate, making it difficult to obtain numerical values for each parameter separately, and the standard errors might be large. The explanatory variables are said to be collinear if the t-tests are insignificant, while their multiple coefficient of determination is significant at the same levels and vice versa. The importance of this test is to isolate those independent variables which would make the results of the regression analysis inadequate in explaining the variability of dependent variables at a specified level of confidence.

Autocorrelation or serial correlation of the random variable is a case where some of its variables are not independent of each other. It may be caused by any of the following:

1. omitted explanatory variables;
2. mis-specification of the mathematical form of the model;
3. interpolations in the statistical observations; and
4. mis-specification of the true random term.

Autocorrelation may affect the parameter estimates and the standard errors in the following ways:

1. The variances of the parameter estimates and those of the error term may be underestimated, thus resulting in inefficient predictions based on the ordinary least squares estimates.

2. The parameter estimates of the ordinary least squares may be statistically unbiased even when the residuals are serially correlated if the expected value of the parameter estimates is equal to the true parameter.

The Durbin-Watson Statistic is used to test for the presence of autocorrelation. The null hypothesis is H_0 : D.W.S. <dl. The alternative hypothesis is H_1 : D.W.S. >du. The test is said to be indeterminate if the calculated Durbin-Watson Statistic is dl <D.W.S. <du.

Solutions for autocorrelation depend on its causes. If it is caused by omitted variables, the model may be redefined to include all the relevant variables. If autocorrelation is a result of mis-specification, it may be solved by changing the initial mathematical form of the model.

Pooling Cross-Section and Time Series Data

The cross-section and time series data used in this research were pooled because twenty-seven out of the twenty-nine selected plants had the same engineering capacity. The disadvantage of pooling the data

was that it obscured the effects of volume of throughput on management, cost profiles, and reserve problems, which would have been obtained by separate cross-sectional analysis of the larger and smaller volume plants.

The Plants' Pricing and Output Policy

Since the co-operative plants' objective is to operate at cost, i.e. to recover their costs of production without making profit, they can price either where their average cost is equal to average revenue or where their marginal cost is equal to their average total costs. The third pricing strategy will be to equate marginal cost to marginal revenue to determine optimum output. As indicated above, this pricing strategy requires information about marginal revenue. For the approach to be reliable, however, the plants' costs should have depreciation which has been adjusted according to changes in the constructions costs.

The fourth pricing strategy is to price on the long-run average cost curve according to a prior determination of throughput, using the mathematical average cost function. Deflated data, with 1971 as the base year, is used so as to facilitate the calculation of prices for different outputs in the subsequent years. The minimum price should be the one obtained at the plants' optimum economic capacity, which is the minimum point on the long-run average cost curve.

Reserves for these plants will be determined in the following way: Calculations for depreciation, based on historical data, will be adjusted annually with the annual percentage increases in the plants' construction costs. For instance, if depreciation for a plant's third year is $3,000 and the percentage increase in its constructions costs

is 10%, depreciation should be $3,300.

In summary, the econometric pricing strategies for the plants will depend on the results obtained from the demand and cost analysis. Plants may choose from among four pricing strategies, which form the main subjects of the subsequent chapters. Following the choice of strategy, the indicated price must be adjusted to accommodate a suitable reserve policy.

CHAPTER IV

CO-OPERATIVE PRINCIPLES AND BUSINESS PRACTICES

The first step in this study was to look at the historical development of co-operative principles and business practices following the Industrial Revolution in Europe in the mid-1700's. The Industrial Revolution in Europe caused technological advancement which, in turn, led to mechanization and the introduction of factories. There was an increase in the production of goods and services, which raised the standard of living and lowered the prices for goods and services. The feudal system collapsed, and mercantilism was replaced by open competition. Although the Industrial Revolution in Europe brought technological progress, it also produced social and economic problems. The workers were exploited, self-sufficiency in agriculture was abandoned, the rate of accidents increased, and unemployment, hunger or shortages of f and class conflicts were common. Economic cycles of inflation an deflation followed.

Solutions to the problems of the Industrial Revolution had to be found. People like Karl Marx and Friedrich Engels proposed the abolition of capitalism and the introduction of a state-controlled system. Others, such as the Rochdale Pioneers and Raiffeisen insisted on the preservation of capitalism and working out ways of improving it.

The Rochdale Pioneers made the work of Robert Owen bear fruit

by introducing the Rochdale Pioneers' Society in 1844, based on the following principles: open membership, one man-one vote, cash trading, membership education, political and religious neutrality, no unusual risk assumption, limited interest on stock, goods sold at regular retail prices, and limitation on the number of stores owned and net margins distributed according to patronage. These co-operative principles are discussed below.

The Rochdale Pioneers were interested in having a co-operative society which would be open to all people who were interested in joining it, irrespective of their sex, race, religious and political beliefs. They went ahead and introduced a society based on open membership. The only barrier to entry was based on bad character or behaviour. Modern co-operatives differ in executing this principle. Before joining a co-operative, application forms are filled out and submitted to the Board of Directors who have the power to reject or accept the applicant. Sometimes it is necessary to limit membership where forces outside the management's control dictate that this be done, such as limited capacity for processing facilities. Co-operatives have certain requirements which applicants have to pass before they are accepted as members. Membership is voluntary, however, and all members are considered to be equal.

The Rochdale Pioneers introduced another principle, that of one man-one vote. This principle gave all members of a co-operative equal voting power, irrespective of the number of shares held and investments each member had with the co-operative. This principle is not practiced by all co-operatives to date. Several methods of voting are used. These methods are:

1. One man-one vote.

2. Vote according to patronage on a dollar volume or some other basis, but with a limitation on votes cast.

3. One man-one vote, plus additional votes based on patronage, on shares of stock, or on some other basis.

4. Vote according to shares of stock. Mississippi Cooperative law provides for an option of voting according to shares of stock, for example.[1]

Some economists, such as Ewell Paul Roy and Emelianoff, argued that it was unfair to expect members holding different shares and investments within a co-operative to have equal votes. Digby went further and stated that even societies making up the British Wholesale Societies held one vote per co-operative society at quarterly meetings, plus additional votes which were proportional to their patronage with the British Co-operatives Wholesale. He insisted that there should be a limit in voting power, but not necessarily one man-one vote. Emelianoff argued that:

> Cooperatives vote equally in their associations because they are, for all practical purposes, economically equal, not because they strive for economic equality. There cannot be a more striking and persuasive illustration of this fact than the very case of the Rochdale Pioneers themselves, who were perfectly equal in their poverty.[2]

This principle, which was introduced to ensure that co-operatives were democratically controlled, is still practiced by many co-operatives. Members of a co-operative have equal voting power and equal control over the affairs of their co-operative. Voting by proxy is permitted in some

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[1]Ewell Paul Roy, *Cooperatives: Today and Tomorrow*, Second Edition (Danville, Illinois: The Interstate Printers and Publishers, 1969), pp. 202, 203.

[2]*Ibid.*, p.203.

co-operatives and disallowed in others.

Cash trading was introduced to encourage thrift on the part of the members and, at the same time, to safeguard the co-operative organization as a whole against loss and possible bankruptcy through bad debts. To date, some co-operatives offer credit facilities, especially in those areas where they are competing with other business enterprises which offer credit facilities. Although cash trading is a good business practice, it may not be regarded as a co-operative principle.

The Rochdale Pioneers provided education to members of their co-operative, because they needed training in business practices and about co-operation. There are co-operatives to date which organize courses for their members and employees; other co-operatives do not organize courses for their members, but all the co-operatives provide knowledge about their co-operative during meetings. Ewell Paul Roy argued that membership education is not a co-operative principle because it is not universally practiced by all co-operatives.

Religious and political neutrality were necessary when the Rochdale Pioneers started their consumer co-operative, because they were interested in getting many members so as to expand their businesss. Most modern co-operatives are open to people of all religions and political parties. There are, however, some co-operatives which are organized on political and religious bases. Religious and political neutrality are not co-operative principles because there are co-operatives which have members of one religion or one political party, yet they are co-operatives. It is, however, advisable for co-operatives to accept membership irrespective of political and religious beliefs.

The Rochdale Pioneers introduced the principle of no unusual risk

assumption because they did not have enough capital. The no unusual risk assumption is not regarded as a co-operative principle because it is very difficult to measure or estimate risk or unusual risk. Speculative ventures may, however, be avoided.

Payment of patronage rebates to the co-operative shareholders, from the co-operative's net earnings, is one of the universally accepted co-operative principles. Rebates are paid to the shareholders of the co-operatives according to the volume of business they have carried out with the co-operatives.

Limited interest on stock was practiced by the Rochdale Pioneers as one of their co-operative principles. The aim of this principle was to discourage outside investors who were not members of co-operatives. Limited interest on capital was introduced for the benefit of those co-operatives which did not deal in stocks. The Rochdale Pioneers had a 5% fixed interest rate. However, the rate depended on the supply and demand for money prevailing in the country concerned at a particular time. In some co-operatives, interest is not paid on common stock, because each member has one share. Limited interest is, however, paid on preferred stock. In the United States of America, the maximum limited interest rate for co-operatives is 8%.

The Roch[illegible] Pioneers' principle of limited number of shares to be owned by each shareholder of a co-operative, is common in many co-operatives today. The aim of limiting the number of shares held was introduced to ensure that the co-operative would be controlled by all members and not a few rich patrons. Ewell Paul Roy argued that this principle was illusory because the principle of one man-one vote ensured equal control of the co-operative's affairs. Secondly, limitation on

the interest rate paid to the preferred stock eliminated the danger of having members investing too much stock with their co-operatives. However, limited numbers of shares, plus one man-one vote principles, ensure equal control of the co-operative by all the patrons.

The Rochdale Pioneers had to make a choice between two pricing policies. One of the policies was to sell at market prices, while the second one was to sell at that price which would have enabled them to cover their operating costs plus interest on stock without making net earnings. The Rochdale Pioneers decided to sell at market prices so as to avoid price wars. To date some co-operatives sell at market prices, while others sell at true costs of production. This is not a co-operative principle, because it is not universally practiced by co-operatives. The policy of selling at prices which can earn revenue enough to cover the costs of production for goods and services is not easy to implement where management cannot easily account for all costs of production and where net earnings are required for future capital investments in the co-operative. Selling at a true cost passes on low prices to the members day by day, while selling at market prices passes on the rebate at the end of the financial year. Co-operatives have to act in accordance with the prevailing marketing conditions under which they are operating.

In summary, the International Co-operative Alliance regards a true co-operative as one which follows the principles of open membership, one shareholder-one vote, limited interest on either stock or capital, limited number of shares owned by each shareholder, and payment of patronage rebates according to participation. The practices which are accepted by the International Co-operative Alliance are co-operation

among co-operatives, voluntary affiliation, plus freedom from state control. While the Rochdale Pioneers advocated cash trading, membership education, political and religious neutrality, no unusual risk assumption, and goods sold at market prices as co-operative principles, they are regarded by today's co-operatives only as good business practices.

Application of Co-operative Principles and Business Practices to Alberta Co-operative Plants

The second step of this research was to test for the application of co-operative principles and business practices to Alberta municipal service co-operative seed cleaning plants. Five principles and five business practices were included in a questionnaire sent to a sample of plant managers. The method of scoring was to allot ten points for the correct application of one co-operative principle or one business practice, and zero for incorrect application of either a co-operative principle or a business practice. The empirical results are presented in Tables 4.1 and 4.2.

The selected large plants follow the principles of open membership, one shareholder-one vote, limited interest on either stock or capital, limited number of shares owned by each shareholder, and payment of patronage rebates according to participation. (Table 4.1) In addition to the co-operative principles discussed above, the large plants follow the business practices listed below:

1. they co-operate with other co-operatives;
2. they have voluntary affiliation and are free from state control.
3. goods and services are sold to the shareholders at prices

Table 4.1

APPLICATION OF CO-OPERATIVE PRINCIPLES AND BUSINESS PRACTICES BY TWELVE SELECTED LARGE ALBERTA MUNICIPAL CO-OPERATIVE SEED CLEANING PLANTS

	No Barriers	No State Control	One Man-One Vote	Voluntary	Operating at Cost	No or Limited Interest on Share Capital	Limited Number of Shares	Pays Rebate	Co-operation Among Co-operatives	Membership Education	Total Percentage per Co-operative
	10	10	10	10	10	10	10	10	10	10	100
	10	10	10	10	10	10	10	10	10	10	100
	10	10	10	10	10	10	10	10	10	10	100
	10	10	10	10	10	10	10	10	10	0	90
	10	10	10	10	10	0	10	10	10	0	80
	10	10	10	10	10	10	10	10	10	0	90
	10	10	10	10	10	0	10	10	10	0	80
	10	10	10	10	10	10	10	10	10	0	90
	10	10	10	10	10	10	10	10	10	10	100
	10	10	10	10	10	10	10	10	10	0	90
	10	10	10	10	10	10	10	10	10	0	90
	10	10	10	10	10	10	10	10	10	10	100
Total	120	120	120	120	120	100	120	120	120	50	1,100
Percentage	100	100	100	100	100	83.33	100	100	100	41.33	92.5

Source: Questionnaire

Table 4.2

APPLICATION OF CO-OPERATIVE PRINCIPLES AND BUSINESS PRACTICES BY SEVENTEEN SELECTED SMALL ALBERTA MUNICIPAL CO-OPERATIVE SEED CLEANING PLANTS

	No Barriers	No State Control	One Man-One Vote	Voluntary	Operating at Cost	No or Limited Interest on Share Capital	Limited Number of Shares	Pays Rebate	Co-operation Among Co-operatives	Membership Education	Total Percentage per Co-operative
	10	10	10	10	10	10	10	10	10	0	90
	10	10	10	10	10	10	10	10	10	0	90
	10	10	10	10	10	10	10	10	10	10	100
	10	10	10	10	10	0	10	10	10	0	80
	10	10	10	10	10	10	10	10	10	0	90
	10	10	10	10	10	10	10	10	10	10	100
	10	10	0	10	10	0	10	10	10	0	80
	10	10	10	10	10	10	10	10	10	0	80
	10	10	10	10	10	10	10	0	10	0	80
	10	10	0	10	10	10	10	10	10	0	90
	10	10	10	10	10	10	10	10	10	10	90
	10	10	10	10	10	10	10	10	10	10	100
	10	10	10	10	10	10	10	10	10	0	80
	0	10	10	10	10	10	10	0	10	10	90
	10	10	10	10	10	0	10	10	10	10	80
	10	10	10	10	10	10	10	10	10	0	90
Total	160	170	150	170	170	130	170	150	170	60	1,500
Percentage	94.117	100	88.235	100	100	76.470	100	88.235	100	35.294	88.235

Source: Questionnaire

which are enough to recover their operating costs without making profit; and,

4. entrance to the co-operative is open to all farmers, irrespective of their religious or political beliefs.

The co-operative business practice which 58.67% of the large selected plants do not apply is that of providing education to co-operative shareholders, the management, and the public. Failure to carry out this co-operative practice could be related to the following: (1) low net earnings, shown in Tables B-14 and B-15; (2) the reserves problem, indicated in Table 2.5; and, (3) attitudes. Most of the managers interviewed are of the opinion that education for the shareholders is not necessary.

The small volume seed cleaning plants differ slightly from the larger ones in the application of co-operative principles and business practices. They also apply all the co-operative principles and practices with the exception of the practice of educating their members and the plants' management. One of the small plants uses one share-one vote, instead of one shareholder-one vote. Another co-operative uses a five shares-one vote system, instead of one shareholder-one vote. The principle of open membership is violated by one of the small co-operative seed cleaning plants which have predetermined membership. The principle of limited or no interest rate for share capital is violated by four of the small seed cleaning plants.

In summary, both large and small volume selected Alberta municipal co-operative seed cleaning plants follow the principles of co-operation as approved by the International Co-operative Alliance in Vienna in 1966, with the exception of the principle of providing

education to their members. They endeavour to operate on a non-profit basis, providing seed cleaning services at the lowest possible cost. For this policy to succeed, however, calculations for depreciation must be based on adjusted rather than on historical data, the aim being to have adequate prices and reserves.

CHAPTER V

EMPIRICAL RESULTS AND ECONOMIC INTERPRETATION

Demand Analysis

The third step in this research was to study the characteristics of the demand for seed cleaning by Alberta co-operative seed cleaning plants. The following demand function was used in this analysis:

$$P = \beta_0 + \beta_1 Q + U$$

where P = seed cleaning service prices in cents per bushel

Q = the amount of seed cleaned in hundreds of thousands of bushels

U = the error term

Demand analysis for twenty-nine selected plants, using cross-sectional data, showed that R^2 was not significant at a 95% level of confidence for any of the separate estimates for the six years from 1971 through 1975, as presented in Table 5.1. The t-test showed that none of the parameter estimates, except the one for 1974, was significant at a 95% level of confidence. The annual horizontal demand curves, plotted in Figure 5.1 show that the plants' demand characteristics are apparently those of perfect competition. However, these appearances are misleading, as the co-operatives were found to operate under conditions of imperfect competition.

Table 5.1

TEST OF SIGNIFICANCE FOR THE $\hat{\beta}$-COEFFICIENTS AND R^2 FOR THE DEMAND MODEL FOR THE 29 SELECTED ALBERTA PLANTS 1970 - 1975*

Year	Intercept	Co-efficient	Standard Error	Calculated T-Value	Signi-ficant	R^{2**}	Calculated F-Value	F 0.95, df†1.27
1970	6.93	-0.04	1.58	-.26	at to.60	0.003	.07	4:212
1971	7.21	-0.01	.01	-.84	at to.70	0.026	.71	"
1972	7.02 (7.36)††	0.01	0.02	0.58	at to.70	0.012	.33	"
1973	7.35 (8.3)	-0.0005	0.02	-0.03	not signi-ficant	0	0	"
1974	6.18 (7.72)	0.05	0.03	2.04	at to.95	0.134	4.17	"
1975	7.20 (9.97)	0.03	0.03	1.00	at to.80	0.036	1.00	"

*Cross-sectional data were used in this analysis.

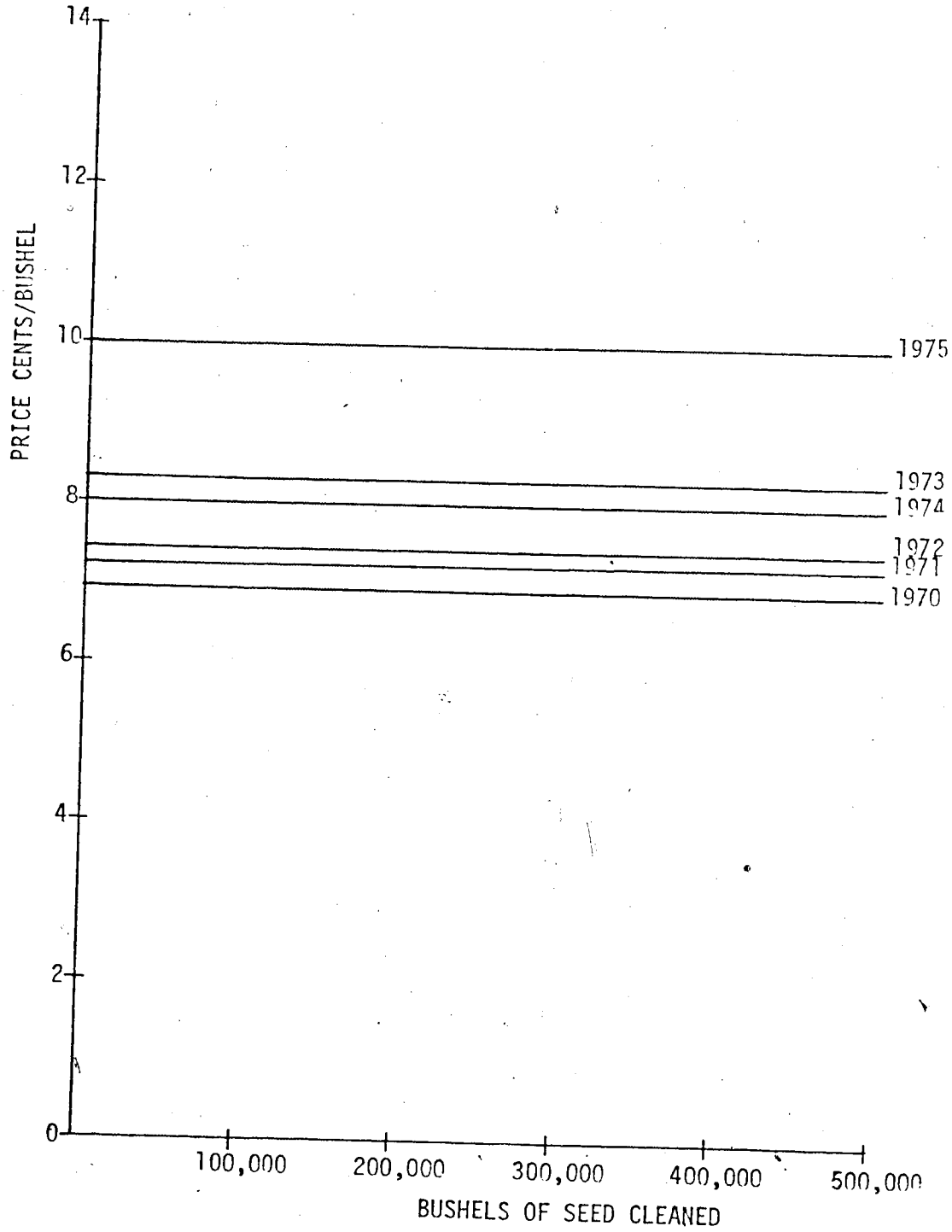
**All R^2 were not significant at 95% level of significance, implying that the amount of seed cleaned by the plants not affected by the seed cleaning prices charged.

†Degrees of freedom.

††Figures in parentheses are the real annual average revenue.

Figure 5.1

DEMAND CURVES FOR 29 SELECTED ALBERTA PLANTS



The conclusion to be drawn from this analysis is that the plants' customers were not strongly price-responsive. The Board of Directors can therefore charge seed cleaning service rates at least within the range of price observed without affecting the demand for the service.

Analysis of the Cost Functions

There were several cost functions used in this empirical study of the plants' costs, and they were: total cost, total variable cost, total average cost, marginal cost, and average variable cost. Cross-sectional and time series data were deflated and pooled in this analysis because the capacity for twenty-seven of the twenty-nine plants was the same. It was deflated with the annual consumer price indexes in Table B-6 to facilitate the comparison of annual prices for different outputs. The empirical results of this analysis are discussed in the following paragraphs.

The Total Cost Function

The total cost function for twenty-nine selected Alberta plants was:

$$C = \alpha_o + \alpha_1 Q + \alpha_2 Q^2 + \alpha_3 Q^3 + U$$

Its empirical results were:

$$\hat{C} = -4.73 + 2.02Q - 0.05Q^2 + 0.0005Q^3$$

Standard errors = (0.93) (0.03) (0.0002)

Calculated T-values (3,170) = (2.179) (-1.898) (2.312)

$R^2 = 0.5275$ $F(3,170) = 63.25$ D-Watson = 2.32

The signs of the coefficient estimates for the cubic total cost function

were consistent with Chiang's[1] restrictions, with the exception of the sign for the intercept, which was negative. These restrictions, which apply to a cubic function, are:

1) $\hat{\alpha}_o$, $\hat{\alpha}_1$, $\hat{\alpha}_3 > 0$

2) $\hat{\alpha}_2$, < 0

3) $(\hat{\alpha}_2)^2 < 3\hat{\alpha}_3\hat{\alpha}_1$

The ordinary least squares estimates of the total cost cubic function were used to plot the total cost curve in Figure 5.2. The parameter estimates for Q and Q^2 were significant at 95% level of confidence. The coefficient estimate for Q^2 was significant at 90% level of confidence. The F-test for R^2 showed that it was significant at 95% level of confidence. The implications of this analysis were that a 95% level of confidence could be placed in the cubic function of throughput in explaining variations in total costs for the plants.

The t-test for autocorrelation showed that there was no autocorrelation while the one for multicollinearity revealed that the explanatory variables were collinear as expected with this specification.

The estimates of the total cost function were used to plot the total cost curve presented in Figure 5.2. Its shape and behaviour is consistent with economic theory. It has two bends, suggested by Chiang[1] and Stafford[2]. The empirical results of the total cost function were used to derive the marginal cost and the average cost functions which were later used in determining prices and output for Alberta plants.

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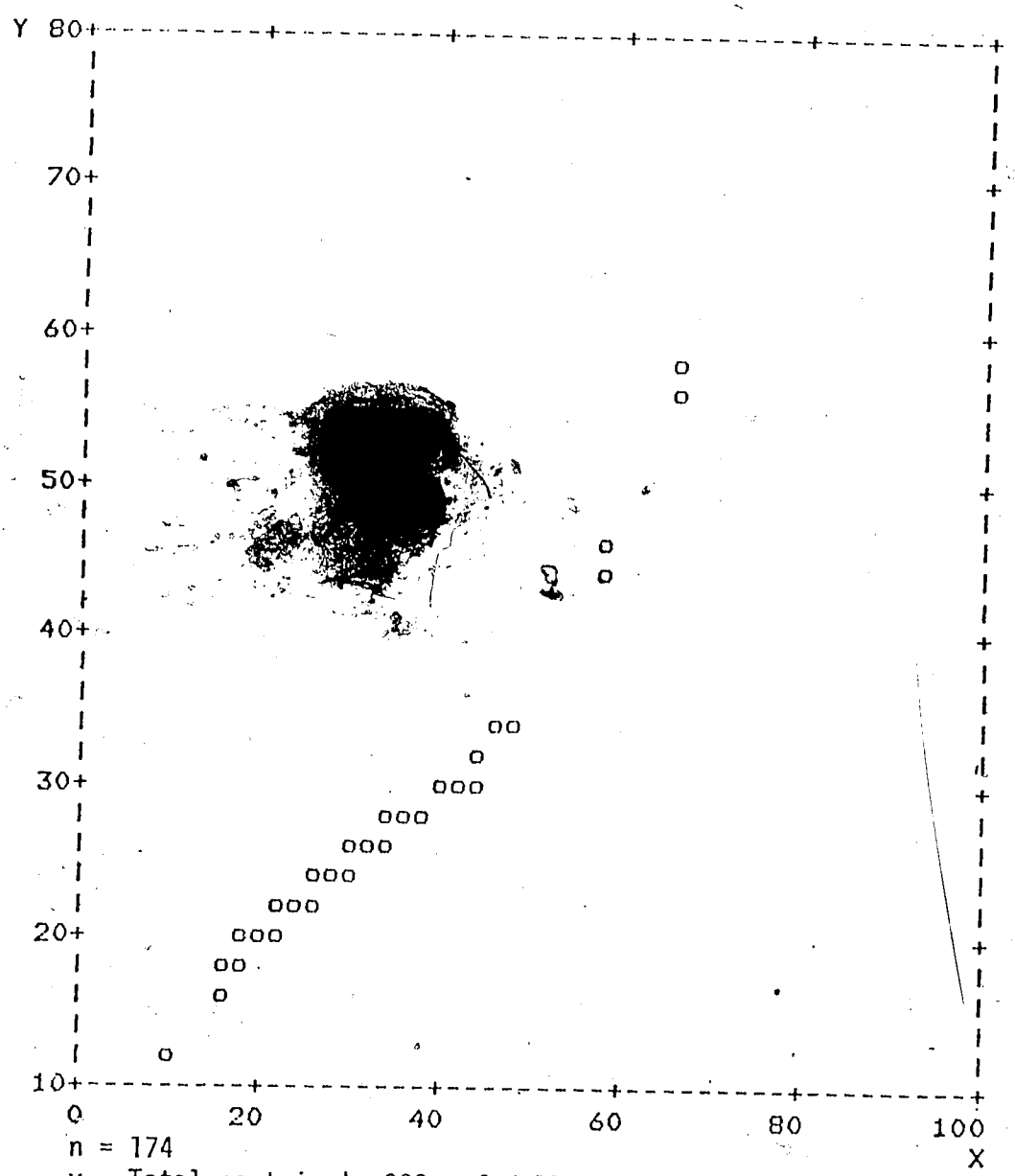
[1]Alpha C. Chiang, *Op. Cit.*, pp. 264,265.

[2]Stafford, *Op. Cit.*, pp. 28,125.

Figure 5.2
THE TOTAL COST CURVE FOR 29
SELECTED ALBERTA PLANTS



n = 174
y Total cost in ' 000s of dollars
x Throughput in '0,000s of bushels of seed

The average total cost function was obtained by dividing ordinary least squares estimates of the total cost function by the number of bushels of seed cleaned by Alberta plants. These estimates were:

$$\hat{ATC} = -4.73\ Q^{-1} + 2.02 - 0.05Q + 0.0005Q^2$$

The average total cost curve plotted from its function first decreases with the increase in output, until the plants' minimum average cost of 9¢ (1975 prices) is reached at the plants' economic capacity of 475,000 bushels of seed, after which it rises. (Figure 5.4) Its U-shape is consistent with economic theory.

The marginal cost function is the first derivative of the total cost function. The results were as follows:

$$\hat{MC} = 2.02 - 0.1Q + 0.0015Q^2$$

The marginal cost curve is U-shaped, as shown in Figure 5.4. It decreases with increase in output until it reaches its minimum, after which it rises. It reaches its minimum before that of the average total cost curve. It cuts the average total cost curve at its minimum. The behaviour of the plants' marginal cost curve is consistent with economic theory.

The Variable Cost Function

The following total variable cost function was used in this analysis:

$$TVC = \gamma_0 + \gamma_1 Q + \gamma_2 Q^2 + \gamma_3 Q^3 + U$$

Its ordinary least squares regression estimates were:

$$\hat{TVC} = -7.91 + 1.40Q - 0.03Q^2 + 0.0003Q^3$$

Standard errors = (0.77) (0.02) (0.0002)

Calculated T-values = (1.82) (-1.47) (1.72)

$R^2 = 0.45$ $F(3,170) = 46.42$ D.W. = 2.4

Table values = $F(3,170) = 2.60$ du = 1.7

The signs of the coefficient estimates were consistent with Chiang's[1] restrictions which are: γ_0, γ_1, $\gamma_3 > 0$; $\gamma_2 < 0$; and $(\gamma_2)^2 < 3\gamma_1\gamma_3$. The t-test indicated that the parameter estimates of the total variable cost function were not significant at a 95% level of confidence. They were, however, significant at a 90% level of confidence.

The F-test for the R^2 showed that it was significantly different from zero at 95% level of confidence. A 95% level of confidence can therefore be put in the plants' output, explaining variations in the total variable costs. The ordinary least squares estimates were used in plotting the total variable cost curve seen in Figure 5.3. Its shape is consistent with economic theory.

The Average Variable Costs Function

The following average variable costs function was obtained by dividing the total variable costs estimates with the bushels of seed cleaned by Alberta plants:

$$\hat{AVC} = -7.91\,Q^{-1} + 1.40 - 0.03Q + 0.0003Q^2$$

The average variable cost curve plotted from this function declines with the increase in output until it reaches its minimum, after which it rises. (Figure 5.4) It is consistent with economic theory.

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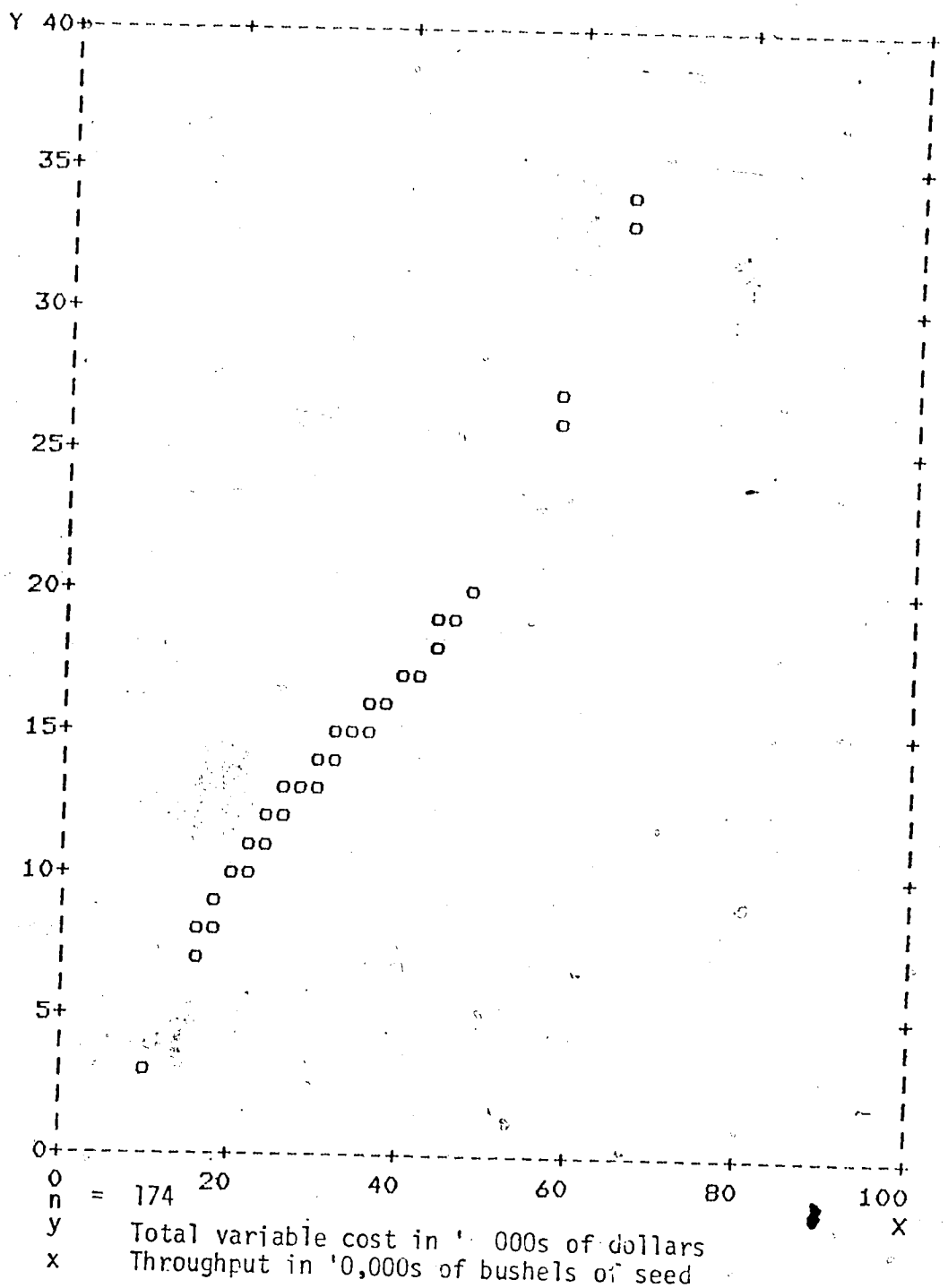
[1]Alpha C. Chiang, *Op. Cit.*, pp.264,265.

Figure 5.3

TOTAL VARIABLE COST CURVE
FOR 29 SELECTED ALBERTA PLANTS



Pricing and Output Policies for Alberta Plants

The fifth step of this study was to determine empirically the output and pricing policies for Alberta plants. The results presented in Figure 5.4, and in Table 5.2 below, show that they priced at their long-run break-even point which is their minimum average total costs.

Table 5.2

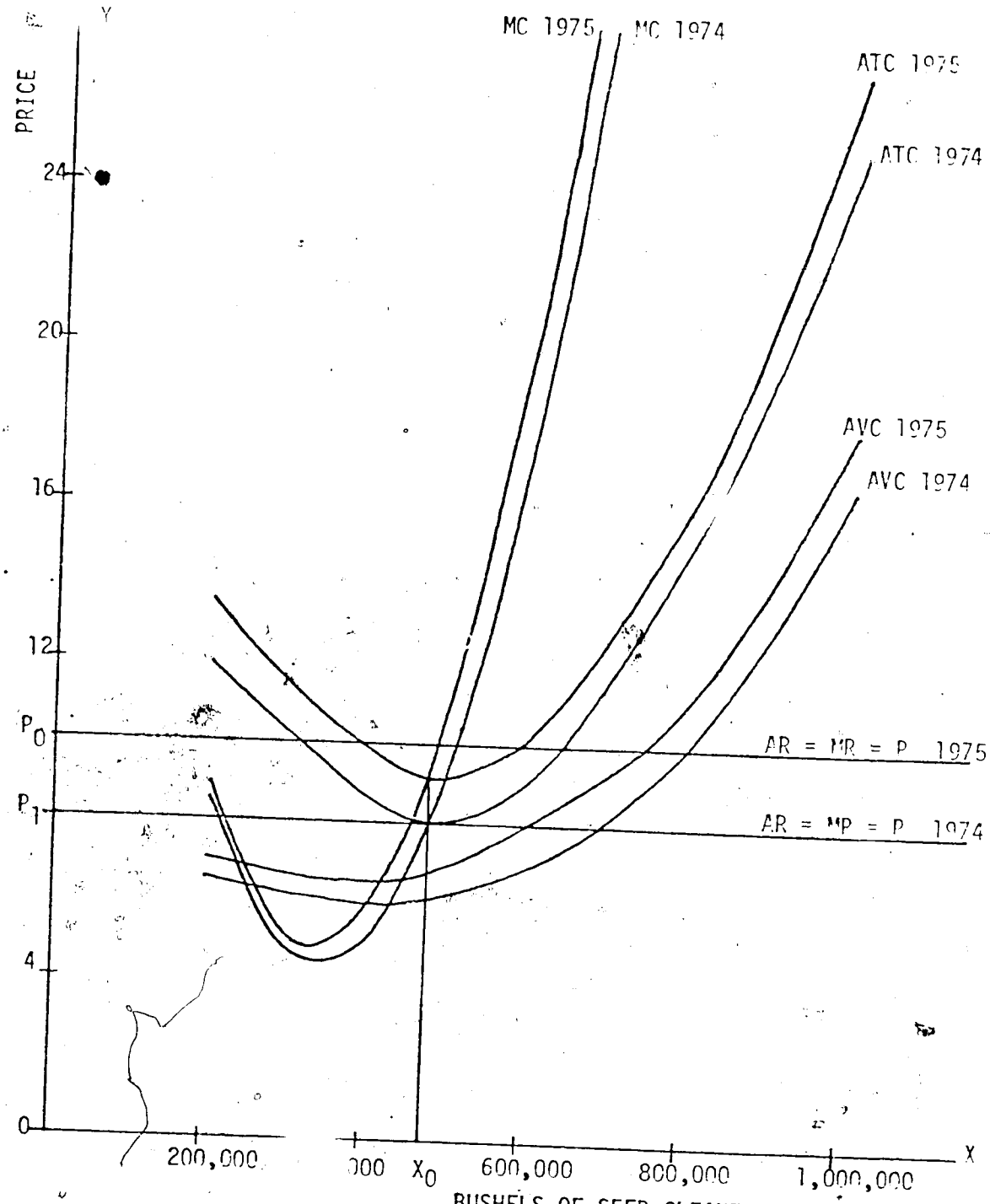
RELATIONSHIP OF AVERAGE REVENUE TO MINIMUM LONG RUN AVERAGE TOTAL COSTS FOR 29 SELECTED PLANTS, 1971-1975

Year	Average Revenue = Price	Plants' Minimum Average Total Cost	Price-ATC
1971	7	6	1
1972	7	7	0
1973	8	7	1
1974	8	8	0
1975	10	9	1

This is consistent with their co-operative business practice of charging prices which are enough to recover their total cost of cleaning seed without making profit. Their output was, however, below their economic capacity of 475,000 bushels of seed. (Table 1.2) In 1975, for instance, twenty-four of the twenty-nine plants sampled, cleaned less than 400,000 bushels of seed and charged 9c instead of pricing at more than 10c average cost per bushel for those throughputs. Ten plants cleaned less than 300,000 bushels of seed and priced at 9c instead of charging more than 11c.

Figure 5.4

PRICES AND OUTPUT FOR 29 SELECTED PLANTS 1974 - 1975



MC = Marginal Cost
ATC = Average Total Cost
AVC = Average Variable Cost
AR = Average Revenue
MR = Marginal Revenue
P = Price
X_0 = Plants Capacity of 475,000 Bushels of Seed

The conclusion drawn from this analysis was that the plants' prices were marginally higher than their long-run minimum average total costs, but lower than the actual average cost for their throughput, hence their low net earnings for the period 1970 - 1975 in Tables B-14 and B-15. They should price at their average total costs at their respective levels of output as the calculations in Table 5.3 show.

Secondly, their pricing policy should be related to their reserve policy. Calculations for depreciation should be adjusted with the percentage increase in construction costs as explained in Table 5.4. For example, the total adjusted depreciation for Beiseker Seed Cleaning Plant in 1975, using the straight line method, would have been $77,025 instead of $42,750 obtained if calculations are based on historical data. Adjusted depreciation of $77,025, plus the interest rate earned over nineteen years, should give an amount which is not far from the 1975 plants' cost of $270,000. Increase in depreciation should lead to higher total costs and low net earnings, if prices are not adjusted. Prices should be changed to reflect changes in the plants' average total cost.

Thirdly, the empirical analysis of the plants' reserve policy between 1970 and 1975 in Tables B-12 and B-13 showed that they were not cumulative over years. The plants' reserves set aside for construction purposes should be cumulative over the life of the plant, which is approximately twenty years.

In summary four pricing and output strategies were considered in this analysis. They were: pricing at (1) minimum average total costs; (2) breakeven point; (3) where marginal revenue is equal to marginal cost; and (4) at the average cost of the plant. Alberta plants

Table 5.3

AVERAGE TOTAL COST FOR THE SELECTED ALBERTA PLANTS AT DIFFERENT LEVELS OF OUTPUT, 1971 - 1975 (IN CENTS PER BUSHEL)

Bushels of Seed	Years				
	1971	1972	1973	1974	1975
100,000	11.00	11.5	12.4	13.7	15.2
150,000	10.7	11.2	12.0	13.4	14.8
200,000	9.8	10.3	11.1	12.3	13.6
250,000	8.9	9.4	10.1	11.2	12.4
300,000	8.1	8.5	9.2	10.2	11.2
350,000	7.5	7.8	8.4	9.3	10.4
400,000	7.0	7.4	7.9	8.8	9.7
430,000	6.9	7.2	7.7	8.6	9.5
450,000	6.8	7.1	7.6	8.5	9.39
475,000	6.4	6.7	7.3	8.1	8.9
500,000	6.8	7.0	7.6	8.4	9.35
550,000	7.0	7.3	7.8	8.7	9.7
600,000	7.4	7.8	8.3	9.3	10.3
700,000	9.8	9.5	10.2	11.3	12.5
800,000	11.6	12.2	13.1	14.5	16.1
900,000	15.2	15.9	17.1	19.0	21.1
1,000,000	19.7	20.7	22.2	24.7	27.3

Table 5.4

STRAIGHT LINE, DOUBLE DECLINING AND THE SUM OF THE YEARS' DIGITS DEPRECIATION FROM HISTORICAL* AND ADJUSTED** CONSTRUCTION COSTS FOR BEISEKER SEED CLEANING PLANT, 1957 - 1975

Year	Plants' Construction Costs	Annual Increase in Construction Costs	Straight Line Method		Double Declining Method		Sum of the Years' Digits Method	
			Historical	Adjusted	Historical	Adjusted	Historical	Adjusted
1957	45,000	0	2,250	2,250	4,500	4,500	4,285	4,285
1958	48,000	3,000	2,250	2,400	4,050	4,350	3,683	3,955
1959	48,000	0	2,250	2,400	3,645	3,645	3,174	3,174
1960	51,000	3,000	2,250	2,550	3,280	3,580	2,740	2,983
1961	51,000	0	2,250	2,550	2,952	2,952	2,370	2,370
1962	51,000	0	2,250	2,550	2,657	2,657	2,053	2,053
1963	51,000	0	2,250	2,550	2,391	2,391	1,779	1,779
1964	54,000	3,000	2,250	2,700	2,152	2,452	1,542	1,728
1965	60,000	6,000	2,250	3,000	1,937	2,537	1,335	1,678
1966	60,000	0	2,250	3,000	1,743	1,743	1,154	1,154
1967	72,000	12,000	2,250	3,600	1,569	1,769	994	1,565
1968	75,000	3,000	2,250	3,750	1,412	1,712	852	981
1969	82,500	7,500	2,250	4,125	1,271	2,021	725	1,011
1970	-	-	2,250	-	1,144	-	610	-
1971	85,500	3,000	2,250	4,275	1,029	1,329	505	591
1972	102,000	16,500	2,250	5,100	926	2,576	409	802
1973	108,000	6,000	2,250	5,400	834	1,434	319	434
1974	144,000	36,000	2,250	7,200	750	4,350	235	749
1975	270,000	126,000	2,250	13,500	675	13,275	154	1,354
TOTAL (19)			42,750	77,025	38,917	119,483	16,082	140,882
Book Value			2,250		6,083			

*Historical construction cost of the plant is the initial cost of building the Beiseker seed cleaning plant in 1957.

**Adjusted data is the book value of the plant plus the annual increases in construction costs.

Note: Straight Line Method: $DSL = \frac{O.C.-S.U.}{n}$

where OC = original cost of the plant

Table 5.4 (continued)

SV = salvage value of the plant replaced
n = expected economic life of the plant and is equal to 20 years.

Double Declining Method:

$$Dddb = \frac{2}{n}R$$

where R = the remaining book value
n = expected economic life of the plant which is 20 years in this case.

The Sum-of-the-Years-Digits Method:

$$Dsotyd = \frac{n-i}{En}(OC - SU)$$

Where n = the expected economic life of the plant and is equal to 20 years
i = age of the plant in years
En = the total of the successful years of depreciable life of the plant, which is 210 years in this example

Source of data:

The Alberta Department of Agriculture, Field Crops Section, *Seed Cleaning Programme* (Edmonton, Department of Agriculture, 1948-1977).

Source of formulae:

John A. Hopkin, Peter J. Barry, and C. B. Baker, *Financial Management in Agriculture* (Danville, Illinois: The Interstate Printers and Publishers, Inc., 1973), pp.99-100.

applied all four strategies in the long run. However, they did not adjust depreciation, which would have led to higher average costs and prices.

CHAPTER VI

SUMMARY, CONCLUSION AND RECOMMENDATIONS

The purpose of this study was to develop a pricing and output framework based on costs, reserves requirements, and the demand characteristics of Alberta co-operative seed cleaning plants. The four pricing strategies proposed and analyzed in this study were to price at the plants' (1) average total costs; (2) break-even point; (3) capacity; and (4) optimum output. These strategies required the following data:

1. total costs, total variable costs, marginal costs, and average total cost;
2. service charges, total revenue, average revenue and marginal revenue, net earnings;
3. the number of bushels cleaned;
4. shareholding and non-shareholding customers;
5. depreciation, share capital and the plants' reserves; and
6. application of co-operative principles by plants.

To facilitate the collection of these data, a stratified simple random sample of twenty-nine plants was selected for this study. These plants were 50% of the fifty-eight that had data for at least six years, from 1970 to 1975. A questionnaire was drafted and tested on two plants before it was sent to the managers of the twenty-nine plants selected. The managers were given at least three weeks within which to complete the questionnaires. They were later visited to explain some parts of

the questionnaire which they might not have understood, and to collect the questionnaires. The data collected was supplemented with secondary data from the plants' annual financial reports kept by the Field Crops Section of the Department of Agriculture. Data were then used in the empirical study of the demand characteristics, nature of costs, and the reserves policy for Alberta plants.

The first step of this research was to analyze the development of the internationally-accepted principles of co-operation and business practices since the Industrial Revolution in Europe in the mid-1700's. The practices accepted by the International Co-operative Alliance were: open membership, one shareholder-one vote, limited interest on either stock or capital, limited number of shares owned by each shareholder, and payment of patronage rebates according to participation. The practices accepted by the International Co-operative Alliance were: co-operation among co-operatives, voluntary affiliation, and freedom from state control. The co-operatives today regard the following as business practices: cash trading, membership education, political an religious neutrality, no unusual risk assumption, and goods sold at market prices.

The second step was to test for the application of co-operative principles and business practices by Alberta plants. They applied all the co-operative principles except that of providing education to their members (which was due to their attitudes and low net earnings.) Their objective was to price at their least cost, and the rebates were credited to the shareholders' share capital.

The third step was to test for the demand characteristics of Alberta plants. Their prices did not change according to the changes

in the amount of seed cleaned, implying that their customers were not price-responsive. The Board of Directors could change prices without affecting the demand for the seed cleaning service.

The fourth step was to study the nature and behaviour of the plants costs. The total cost and total variable costs were cubic functions of the plants' throughput. The shape and behaviour of the marginal, average total and average variable cost curves were consistent with economic theory.

The fifth step was to analyze the pricing strategies for Alberta plants. The results showed that they priced at their long-run break-even point, which was the same as their economic capacity of 475,000 bushels of cleaned seed, and their optimum output. Their average revenue was either equal to their minimum average total cost, or higher by one cent. The amount of seed cleaned by these plants was, however, less than their economic capacity of 475,000 bushels of seed. Their average revenue was therefore less than the average total cost corresponding to their throughput. The recommendation, based on this analysis, is that prices should be increased so as to equate their average revenue with their average cost. Their throughput should also be increased to their economic capacity so as to lower their average costs.

The sixth step was to study the plants' reserve policy. The empirical results showed that the plants' reserves were not cumulative over the life of the plant. Depreciation was calculated from historical data and was not cumulative because it was a book value. The plants, therefore, did not have an appropriate reserve policy. They need one, especially if they are to fill the gap left by the termination of construction and renovation grants from the Alberta government. The

recommendation, based on this study, is that the plants' depreciation should be adjusted with the increase in the plants' construction costs. It should be set aside for use in constructing the new plant after a period of approximately twenty years. The reserves set aside should therefore be cumulative and earn interest. Prices should be adjusted to reflect increased average total cost, resulting from increasing the depreciation allowance.

The weaknesses of this research are mainly those resulting from the use of pooled data, unadjusted cost data, average prices, and total costs which are less than the actual costs. These weaknesses are discussed below.

The sample which originally comprised two strata of high volume and low volume plants, was later pooled because twenty-seven out of twenty-nine plants had the same engineering capacity of cleaning 150 bushels of seed per hour. The difference in the behaviour of the low and high volume plants with regard to pricing output, and the reserves strategies, was obscured by the use of pooled cross-section and time series data.

The prices used in this analysis were the average of the actual seasonal prices used by the plants. These prices are used to persuade the farmers to deliver seed throughout the year, instead of having a rush in spring and late winter. Their average was used in this study because there was no corresponding output for different seasons. The average prices from this analysis are annual prices, and may not help in persuading the farmers to deliver seed in winter and fall to avoid congestion in spring and late winter.

The results of this analysis showed that the cost data used was

not adjusted to cater to increase in the plants' total costs. The average prices calculated from the empirical average total cost function are therefore less than what they should have been if depreciation had been adjusted.

The third weakness is that of using the total cost data from the financial statements of those plants which clean and treat seed. The expenses for seed cleaning are not recorded differently from those incurred in treating seed. It is therefore not easy to know how much was spent on each, when it comes to items like salaries, wages, audit fees, utilities, insurance, and property taxes. The total cost data used in this analysis is a ratio of the plants' seed cleaning revenue to that of their total revenue.

In conclusion, Alberta co-operative plants' pricing objective is to produce at cost by charging prices which are enough to meet their average total costs. Their reserves should be cumulative, and their depreciation should be adjusted to reflect increase in construction costs. Their prices should be increased to reflect increases in their average total cost resulting from increased adjusted depreciation. The amount of seed they clean should also be increased toward their economic capacity of 475,000 bushels.

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APPENDIX A

DATA USED IN THE INITIAL STUDY WHICH TESTED THE PRICE MODEL

Table A-1

SERVICE CHARGES, AGE, FIXED COSTS, VARIABLE COSTS, REVENUE AND THROUGHPUT FOR ALBERTA CO-OPERATIVE SEED CLEANING PLANTS, 1970-73

	Service Charge (¢)	AGE (in years)				FIXED COSTS (in dollars)				VARIABLE COSTS (in dollars)				REVENUE (in dollars)				THROUGHPUT (in bushels)			
		70	71	72	73	70	71	72	73	70	71	72	73	70	71	72	73	70	71	72	73
1	8.00	13	14	15	16	8816	8816	9783	9783	9311	9311	11841	11841	16994	16994	20853	20853	185741	190973	198795	228499
2	7.00	14	15	16	17	3596	3455	12288	13848	25272	27610	17589	21029	39498	38993	36373	36430	412192	417470	379882	382790
3	8.00	10	11	12	13	11450	11450	10639	11678	26708	26708	23345	26949	38576	38576	35985	37471	320010	398293	416561	411613
4	9.00	13	14	15	16	18220	18230	11761	13053	11761	11761	18230	24530	32677	32667	32777	42867	354198	329469	288372	339112
5	9.00	9	10	11	12	9096	8711	13146	13146	14481	13146	8711	8711	20960	19064	19064	8489	384217	264384	195908	181847
6	11.00	14	15	16	17	3864	15433	15433	15433	13864	15433	15433	15433	22633	19536	19536	19536	280516	217670	213190	269365
7	9.00	3	4	5	6	7844	7844	8196	11292	8196	8196	7844	12566	16757	16757	16757	23950	99972	205023	232621	333482
8	8.00	9	10	11	12	5865	6060	13284	14339	19095	19954	15488	19023	28847	32556	32433	37851	358360	392736	366077	386422
9	9.00	2	3	4	5	14775	14775	8024	8024	3326	3326	8288	8288	13471	13471	16387	16387	168650	170163	191286	198150
10	11.00	2	3	4	5	2912	2912	20725	19737	13905	13901	13972	20656	18407	18407	26[illegible]	[illegible]	241061	235157	264409	215934
11	9.00	6	7	8	9	5008	5008	11236	13283	17498	17498	10860	16900	24247	24247	26[illegible]	[illegible]	210308	218698	233522	209395
12	10.00	6	7	8	9	8842	6807	16275	17048	25717	32978	22891	27970	34578	51163	40995	[illegible]	307542	429670	372332	336150
13	9.00	8	9	10	11	4461	5072	12843	16361	7377	7720	6246	11563	14829	18148	25[illegible]	[illegible]	204712	218312	187199	170475
14	7.50	4	5	6	7	3198	3267	15375	15375	14156	15375	3267	3267	19772	21552	21552	21552	248053	242255	215259	256097
15	10.25	2	3	4	5	2216	2827	9454	13480	10323	11643	7503	12236	14262	12166	14599	25722	165[illegible]	162917	174976	177424
16	8.50	8	9	10	11	6397	5590	11925	11651	27[illegible]	26426	18877	25104	26239	34008	31200	36888	381731	414638	355096	374598
17	10.00	10	11	12	13	15638	15638	21283	21872	48498	48498	37379	38456	64136	64136	58565	60328	448[illegible]	552422	575755	586965
18	10.50	13	14	15	16	21871	21871	12419	12498	15865	15[illegible]	9504	12403	26760	26760	20960	25876	181[illegible]	199135	131305	69063
19	8.00	4	5	6	7	12922	12922	13053	16006	9709	9709	11540	14149	24215	24215	25261	28415	232293	242846	242738	255423
20	9.00	7	8	9	10	17622	17622	9229	13755	9229	9229	17622	13141	24812	24812	24812	27422	307506	271975	276974	263957
21	8.00	7	8	9	10	8000	7362	14916	12981	16791	14961	12218	12218	21195	21623	23008	23008	335277	297019	273122	323590
22	9.00	8	9	10	11	6706	6706	9020	15671	13180	13180	7725	5678	21333	21333	16993	21089	165100	241195	232502	304250
23	8.67	4	5	6	7	737	13349	12630	14389	15934	15934	13349	13101	20411	20411	21537	24941	197530	266571	266368	291592
24	8.00	10	11	12	13	5146	3857	12475	12475	12713	12498	10899	10892	18544	21425	21483	21483	240[illegible]	278[illegible]	269393	255607
25	8.00	11	12	13	14	7056	5765	14426	14485	28515	29759	23988	19994	37863	40289	42020	39165	322772	346880	371756	314556
26	8.00	12	13	14	15	2295	2087	17183	9525	17515	17182	13915	13915	20345	19907	21316	21316	275868	265769	282235	273042
27	7.00	15	16	17	18	2698	3562	10333	12049	26577	26472	36201	41465	33826	34840	46993	59128	345579	377488	359972	332205
28	8.00	16	17	18	19	2731	2731	10384	10384	20623	20623	15059	15059	25484	25484	28137	28137	253096	210094	239275	276643
29	9.50	1	2	3	4	2460	2460	15608	16543	17898	17898	9455	12260	20358	20358	22421	23761	103075	221293	256077	285317

Table A-1 (continued)

	Service Charge (¢)	AGE (in years)				FIXED COSTS (in dollars)				VARIABLE COSTS (in dollars)				REVENUE (in dollars)				THROUGHPUT (in bushels)			
		70	71	72	73	70	71	72	73	70	71	72	73	70	71	72	73	70	71	72	73
30	7.50	19	20	21	22	24437	22980	12245	10416	6193	6282	21032	21089	31332	29774	30976	30377	404684	374105	361314	359930
31	8.67	6	7	8	9	19735	21911	14037	14702	12051	16927	25108	42299	28778	39993	39622	56824	236756	294425	273851	288361
32	7.50	3	4	5	6	4579	4579	15589	16015	13379	13379	10524	40654	20961	20961	55807	55807	208805	229709	205020	242499
33	6.00	21	22	23	24	8687	7749	31630	26623	30562	37876	7581	8204	46942	49034	36819	43029	453357	446787	442956	504194
34	6.00	18	19	20	21	3311	2885	16509	16509	15605	16509	2885	2885	23381	25896	25896	25896	403273	383000	352726	377311
35	9.00	11	12	13	14	6246	7488	13304	14260	15106	14628	20880	29296	23757	27757	36634	48740	301192	331755	323323	414582
36	10.00	11	12	13	14	6777	3967	11251	10470	10381	10384	16904	16054	15514	13702	12712	14600	187908	167310	152993	173229
37	8.00	5	6	7	8	11882	11882	12666	13360	12666	12666	11892	12645	21459	21459	21459	25077	363539	352084	337273	380773
38	9.00	5	6	7	8	12896	12896	9759	10233	17398	16093	12026	11557	19387	14725	20354	16239	212993	189393	202487	169000
39	7.00	16	17	18	19	2687	2498	10915	11033	18911	16498	14791	18796	24079	22627	24895	32285	347634	310098	225880	245936
40	9.33	8	9	10	11	2388	2346	13006	9205	13315	12773	9803	14156	15753	17222	19781	18946	203121	215161	215648	205519
41	9.00	10	11	12	13	3772	3772	13890	14125	21170	21170	23276	28588	30623	30623	39395	51264	378339	398371	358892	381509
42	9.00	10	11	12	13	7059	7059	12329	11885	12329	12329	7059	10435	17064	17064	17064	22632	304181	293277	169185	174071
43	5.50	12	13	14	15	3244	4889	18140	10070	25355	22279	14957	19739	30778	31827	29649	30576	407460	416804	425161	443280
44	8.00	17	18	19	20	13406	13406	23931	29996	19898	22425	13806	13801	27669	29609	38485	42357	262017	284319	256789	266841
45	8.00	10	11	12	13	3223	3223	12745	25946	32229	32229	12577	12354	35451	35451	33785	36432	338088	410573	416833	417607
46	8.00	10	11	12	13	17437	17437	13865	11526	13865	13865	17437	22400	28878	28878	28878	29364	240261	290717	248883	270181
47	7.50	15	16	17	18	3994	4214	12632	12632	21202	22125	17842	17842	31774	34667	27054	27054	267970	438424	306705	367628
48	8.00	13	14	15	16	3098	2955	22182	22182	22948	22182	2055	2955	41356	43111	43111	43111	439428	392785	321606	361731
49	8.00	17	18	19	20	3283	3283	23285	32009	22694	22694	4315	2905	30595	30595	30455	38345	302181	296342	294603	342052
50	8.50	12	13	14	15	6574	6574	52581	94740	23600	23600	13814	17496	26701	26701	24305	26266	339783	284131	323346	298382
51	9.00	18	19	20	21	2217	2067	12229	11500	19737	20428	9861	10778	21336	22458	19338	20259	262932	270402	246265	261245
52	8.50	17	18	19	20	1745	1745	10952	13927	31400	31400	22790	21763	32566	32033	32033	32033	449955	484953	426640	377476
53	8.50	1	2	3	4	852	1580	2799	2799	6234	2799	1580	1580	8165	13027	13027	13027	110266	185023	183226	186315
54	8.00	12	13	14	15	4287	3905	16997	14319	15832	16799	12415	12415	23528	22072	21182	32757	228294	249612	206644	232439
55	8.00	12	13	14	15	6604	6604	16050	16050	22669	15724	17715	20603	29456	29456	33550	35449	423282	358604	339399	347021
56	9.00	6	7	8	9	5751	5475	12869	12373	17083	23676	22435	27019	24787	28911	32834	41644	210519	235625	218167	245424
57	9.00	21	22	23	24	16844	16844	10209	10330	10209	10209	16844	20894	27538	27538	27538	34069	349381	256434	214357	315615
58	7.00	21	22	23	24	1899	1899	12300	13735	13311	14338	18827	24237	21175	22776	30656	40533	233927	247796	243163	253552

APPENDIX B

SUPPORTING DATA

FOR

THIS STUDY

Table B-1

TOTAL REVENUE FOR SELECTED ALBERTA PLANTS
(1970 - 1975)

1970	1971*	1972	1973	1974	1975
		LARGE VOLUME PLANTS			
19,624	25,707	[illegible],264	24,766	23,188	27,272
21,691	22,953	[illegible]9,36[illegible]	20,984	23,287	20,973
7,699	15,789	[illegible]	19,727	17,786	24,909
23,238	28,341	24,[illegible]	23,386	20,766	31,119
49,258	52,535	43,850	42,489	42,450	74,485
29,406	32,780	30,080	19,535	24,518	29,225
19,242	22,581	21,739	28,117	26,601	24,008
24,143	23,262	20,203	21,554	24,388	27,680
27,563	27,563	27,000	26,048	32,512	28,862
21,700	22,685	20,643	20,026	20,673	18,658
24,691	19,974	26,166	24,331	23,522	16,947
13,319	17,756	14,816	18,462	22,133	27,717
		SMALL VOLUME PLANTS			
19,682	17,572	13,255	12,653	18,136	24,116
19,513	16,436	15,683	35,464	31,975	28,858
15,835	15,835	17,620	18,799	20,573	23,252
16,086	17,239	17,473	16,248	20,588	18,724
13,493	13,771	13,922	13,739	17,560	18,790
20,339	19,650	17,820	17,649	21,244	18,223
14,724	17,577	15,729	14,584	13,149	11,867
15,498	20,956	17,628	17,000	18,044	17,616
12,938	12,571	10,738	11,011	17,340	16,121
14,136	16,070	15,086	13,980	20,748	22,942
19,198	20,115	10,282	11,318	13,276	14,557
19,198	19,198	17,275	17.767	20,536	19,583
17,377	18,320	15,842	15,973	14,401	12,997
18,302	17,287	13,330	14,152	11,391	10,280
13,276	16,893	15,061	16.014	16,620	18,845
12,716	15,019	12,467	12,709	16,300	18,161
13,545	18,596	17,929	19,929	20,796	26,481

*The annual average consumer price indexes were used to deflate the figures (1971 = 100).

Table B-2

FIXED COSTS FOR THE SELECTED ALBERTA PLANTS
(1970 - 1975)

1970	1971*	1972	1973	1975	1974
		LARGE VOLUME PLANTS			
12,306	13,421	10,639	11,678	15,087	16,801
10,776	10,773	11,761	13,055	12,315	14,360
7,884	7,844	8,198	11,292	14,916	15,690
14,386	13,752	11,925	11,651	14,639	17,170
13,758	26,904	21,283	21,872	26,669	28,120
17,745	16,951	14,426	14,485	14,472	16,621
11,641	11,826	13,304	14,260	13,395	24,599
12,149	12,210	13,890	14,125	16,260	21,562
13,939	13,939	12,677	12,354	15,590	16.886
10,333	11,312	17,842	12,632	12,981	12,981
12,403	13,283	9,638	11,548	16,350	20,467
6,706	10,072	9,020	15,671	14,964	15,925
		SMALL VOLUME PLANTS			
9,096	8,711	8,711	8,489	12,281	18,821
8,290	9,562	15,433	15,433	15,736	17,621
10,575	10,423	11,236	13,233	10,293	12,890
11,538	11,769	11,769	10,044	11,448	15,299
9,030	12,922	13,063	16,006	13,176	16,361
14,106	14,106	9,229	13,755	14,951	14,951
8,366	7,740	[illegible]	12,475	12,475	12,475
13,253	15,592	[illegible]	14,702	17,287	13,494
9,157	9,158	16,904	16,054	10,250	11,577
12,135	11,452	13,006	9,205	10,481	14,762
12,329	12,329	12,329	11,885	11,624	17,202
10,951	12,186	13,406	13,201	13,585	16,962
9,142	9,215	9,861	10,778	10,778	10,778
7,991	7,996	12,415	12,415	9,701	9,701
10,616	10,581	12,869	12,373	15,732	20,791
4,461	5,072	9,638	11,548	13,592	19,772
5,093	5,904	12,630	14,309	14,683	19,070

*Consumer price index was used to deflate the figures, (1971 = 100.)

Table B-3

TOTAL VARIABLE COSTS FOR SELECTED ALBERTA PLANTS
(1970 - 1975)

1970	1971*	1972	1973	1974	1975
		LARGE VOLUME PLANTS			
26,550	23,486	20,645	22,156	21,575	17,181
13,349	14,905	12,588	13,324	13,110	15,762
8,196	8,196	7,186	9,866	15,172	11,927
19,220	16,902	16,623	20,316	11.711	19,086
28,848	34,353	32,809	31,288	27,436	42,979
17,837	18,563	19,085	13,597	14,490	13,955
9,711	12,090	15,673	18,133	14,353	19,802
15,327	12,732	16,938	17,561	20,489	23,231
19,533	19,553	19,027	19,802	22,805	23,745
12,512	12,590	12,053	14,502	13,004	11,738
25,659	24,236	12,668	7,608	15,248	12,666
13,180	9,793	7,361	5,038	11,200	14,627
		SMALL VOLUME PLANTS			
14,481	13,146	12,543	7,243	12,884	18,129
8,625	11,325	14,726	13,693	20,404	20,119
8,381	8,736	7,619	11,434	10,518	12,901
8,473	9,545	9,107	11,983	14,289	20,202
7,233	7,233	7,617	7,083	11,096	10,553
20,178	20,178	15,984	10,200	10,479	9,457
8,232	7,297	11,903	7,994	7,208	6,505
14,680	19,267	18,438	27,385	28,257	35,546
8,001	7,260	10,735	9,290	5,528	8,687
9,692	7,797	9,354	8,920	10,989	8,017
7,059	7,059	3,932	3,567	2,554	3,836
24,543	26,833	22,834	26,615	17,774	19,541
11,978	12,567	10,750	9,706	8,751	7,898
12,128	12,709	16,029	12,705	13,009	11,741
11,727	20,738	13,365	22,865	10,987	15,581
7,377	7,720	10,512	7,608	13,378	14,158
8,351	9,516	12,737	17,171	11,493	17,338

*Consumer price index was used to deflate the figures, (1971 = 100.)

Table B-4

TOTAL COSTS FOR THE SELECTED ALBERTA PLANTS
(1970 - 1975)

1970	1971*	1972	1973	1974	1975
		LARGE VOLUME PLANTS			
38,856	36,907	30,797	32,518	33,644	29,311
24,125	25,678	23,811	24,908	22,962	26,130
16,040	16,040	15,006	19,886	27,104	23,249
33,606	30,654	28,001	30,654	23,422	31,438
42,606	61,257	53,117	50,695	48,772	63,282
35,582	35,514	32,851	26,449	26,068	25,955
21,352	23,916	28,368	30,787	25,069	37,563
27,475	24,942	30,192	30,094	33,497	38,799
33,472	33,492	31,124	30,763	35,277	35,937
22,845	23,902	29,078	25,710	23,389	21,109
38,062	37,519	21,865	17,855	28,328	27,444
19,886	19,865	15,968	18,943	23,171	26,125
		SMALL VOLUME PLANTS			
23,577	21,857	20,855	14,775	22,709	31,718
16,915	20,887	29,452	27,387	32,992	32,841
18,956	19,159	18,340	23,176	18,752	22,208
20,011	21,314	20,3[illegible]	20,8[illegible]	23,448	31,[illegible]48
16,253	20,155	19,9[illegible]	21,2[illegible]	21,636	22,366
34,284	34,284	24,7[illegible]	22,405	22,440	20,252
16,598	15,037	22,2[illegible]	19,063	17,188	15,512
27,933	34,859	31,833	40,430	42,087	45,289
17,158	16,418	26,865	23,535	13,728	17,045
21,827	19,249	21,764	17,087	19,374	18,675
19,388	19,388	15,696	14,113	11,853	16,256
35,494	39,019	35,626	38,329	28,642	31,788
21,120	21,782	20,160	19,269	17,373	15,680
20,119	20,705	27,875	23,721	20,770	18,745
22,343	31,319	25,645	33,843	23,572	30,593
11,838	12,792	19,708	17,855	24,252	28,434
13,444	15,420	24,789	29,867	23,840	31,172

*Consumer price index was used to deflate the figures, (1971 = 100.)

Table B-5

SERVICE CHARGES* FOR NON-SHAREHOLDERS OF THE SELECTED ALBERTA PLANTS (IN ¢/BUSHEL)

1970	1971	1972	1973	1974	1975
		LARGE VOLUME PLANTS			
7.88	7.88	8.77	8.37	10.38	11.38
7.00	9.00	9.00	9.00	9.00	11.00
9.00	9.00	10.50	10.50	12.50	15.50
8.50	8.50	9.00	10.00	10.00	12.00
10.00	10.00	10.00	10.00	17.00	17.00
8.00	8.00	9.00	10.00	13.00	15.00
8.00	9.00	10.00	10.00	12.00	14.00
9.00	9.00	10.00	10.00	12.00	12.00
8.00	8.00	12.00	12.00	13.00	15.00
7.55	7.50	8.00	10.00	12.00	14.00
8.00	8.00	10.00	11.00	13.00	14.00
9.00	9.00	10.00	11.00	13.00	16.00
		SMALL VOLUME PLANTS			
9.00	9.00	10.50	10.50	[illegible].00	13.50
11.00	11.00	11.00	12.00	13.00	14.00
9.00	9.00	9.25	9.25	10.25	[illegible]75
7.50	7.50	9.00	10.00	[illegible].00	14.00
8.00	8.00	8.50	10.25	10.25	12.25
9.50	10.50	11.50	12.50	12.50	17.50
8.00	8.00	9.00	9.00	11.00	14.00
8.67	8.67	9.67	9.67	11.67	11.67
10.00	10.00	11.00	12.00	13.00	15.00
9.33	9.33	9.33	10.50	10.50	12.50
9.00	9.00	9.00	10.00	11.00	12.00
8.00	8.00	9.00	9.00	10.33	10.33
9.00	9.00	9.00	9.00	10.33	11.75
8.00	8.00	8.00	8.00	12.38	12.50
9.00	9.00	9.00	10.00	11.00	11.00
9.00	9.00	10.00	10.00	12.00	12.00
8.67	8.67	10.00	10.00	12.00	14.00

*These service charges are the averages of several prices paid during different periods of the year.

Source: Questionnaire

Table B-6

CONSUMER PRICE INDEXES
(1971 = 100)

Month	1970*	1971	1972	1973	1974	1975
January		97.7	102.5	108.3	118.1	132.4
February		98.1	102.9	108.9	119.3	133.4
March		98.4	103.0	109.2	120.5	134.1
April		99.1	103.6	110.4	121.4	134.8
May		99.5	103.7	111.2	123.4	135.9
June		99.7	103.8	112.2	125.0	137.9
July		100.5	105.1	113.2	125.9	139.8
August		101.2	105.9	114.7	127.1	141.2
September		101.0	106.3	115.4	127.9	141.5
October		101.1	106.4	115.7	129.1	142.8
November		101.5	106.7	116.6	130.5	144.1
December		102.2	107.4	117.2	131.8	144.3
Annual Averages		100.0	104.8	112.7	125.0	138.5

*Indexes for 1970 were not used because their base year was that of 1961.

Source: Statistics Canada, *Consumer Prices and Price Indexes*. Catalogue #62-010. Ottawa: Statistics Canada, April - June 1976. p.24.

Table B-7

CONSTRUCTION GRANTS AND COSTS
FOR ALBERTA PLANTS
1948-1977

Year	Grants from Alberta Department of Agriculture	Plants' Construction Costs	Annual Increase in Construction Costs
1948	13,000	39,000	
1949	13,000	39,000	0
1950	13,000	39,000	0
1951	13,000	39,000	0
1952	13,000	39,000	0
1953	13,000	39,000	0
1954	13,000	39,000	0
1955	14,000	42,000	3,000
1956	15,000	45,000	3,000
1957	15,000	45,000	0
1958	16,000	48,000	3,000
1959	16,000	48,000	0
1960	17,000	51,000	3,000
1961	17,000	51,000	0
1962	17,000	51,000	0
1963	17,000	51,000	0
1964	18,000	54,000	3,000
1965	20,000	60,000	6,000
1966	20,000	60,000	0
1967	24,000	72,000	12,000
1968	25,000	75,000	3,000
1969	27,500	82,500	7,500
1970	------	------	------
1971	28,500	85,500	3,000
1972	34,000	102,000	16,500
1973	36,000	108,000	6,000
1974	48,000	144,000	36,000
1975	90,000	270,000	126,000
1976	------	------	------
1977	116,660	349,980	179,980

Note: From 1948 to 1975, the Alberta Department of Agriculture, the local municipality, and the co-operative concerned, each contributed one-third of the construction costs of the plant. However, the maximum agriculture grant from December 26, 1975 to 1980 is $15,000. Therefore, the amount of $116,660 for 1977 represents one-third of the construction costs which the plants would have received, and not the actual grants given to them that year.

Table B-8

CONSTRUCTION GRANTS* FROM THE ALBERTA DEPARTMENT OF AGRICULTURE TO THE SELECTED LARGE VOLUME ALBERTA SEED CLEANING PLANTS

Name of Plant	Grant in $	Year
Beiseker	15,000	1957
Boyle	24,600	1967
"	10,960	
"	3,300	1975
Fairview	17,000	1967
Falher	17,000	1960
Innisfail	16,000	1959
"	15,000	1976
Nanton	16,000	1959
Provost	17,000	1960
"	15,000	1976
Rycroft	17,000	1960
Stony Plain	14,000	1955
"	15,000	1976
Strathmore	15,000	1957
"	11,250	1973
"	50,416	1975
Grimshaw	17,000	1962
"	9,403	1975

Note: These grants were used in either the initial construction, or in the renovation of buildings and machinery for the above selected plants.

Table B-9

CONSTRUCTION GRANTS FROM THE ALBERTA DEPARTMENT OF AGRICULTURE TO THE SELECTED SMALL VOLUME ALBERTA SEED CLEANING PLANTS

Name of Plant	Grant in $	Year
Bentley	17,000	1961
Blackie	15,000	1955
"	8,000	1970
Coronation	18,000	1964
Edgerton	20,000	1966
Enchant	25,000	1968
Forestburg	20,000	1966
Gibbons	17,000	1963
Holden	17,000	1960
Medicine Hat	18,000	1964
Okotoks	16,000	1959
"	4,494	1976
Ponoka	17,000	1962
Queenstown	17,000	1960
Rosebud	13,000	1952
Vegreville	13,000	1952
Vulcan	16,000	1958
Warburg	18,000	1964
Delia	17,000	1962
High Prairie	20,000	1966

Note: These grants were used in either the initial construction or in the renovation of buildings and machinery for the above selected plants.

Table B-10

SELECTED LARGE VOLUME PLANTS' SEED CLEANING MACHINERY AND CAPACITY (1970-1975)

Name of Plant	Machinery			Plants' Capacity Bushels/Hour
	Indent	Wind and Screen	Precision Grader	
Barrhead	ST4B	CR	-	150*
Beiseker	ST4A	CR #M5472	HC6	150
Boyle	HC #SG22	CL #248DH	-	150
Fairview	2HEU	CR #M5472	-	187**
Falher	ST4B	CL #248DH	-	150
Innisfail	ST4B	CL #248DH	HC6	150
Nanton	2ST4B	CL #248D	[illegible]	187
Provost	ST4B	CR #M588	-	150
Rycroft	ST4B	CL #248DH	HC6	150
Stony Plain	HEU	CL		150
Strathmore	ST4B	CL #248DH		150
Grimshaw	HEU #SG22	CL #M588		150

Legend for Manufacturing Companies

CL: Clipper
CR: Crippen
HC: Hart Carter
HEU: Hart Emerson Uniflo
ST4: Superior Terminal Four

*150 bushels (as used in Tables 1.8 and 1.9,) is the optimum amount of seed which plants can clean per hour to achieve high quality planting seed and still allow enough time for cleaning the machines. The average number of bushels to be cleaned per hour, given in a report on "Evaluation of Seed Cleaning Machines," by Krishan Kunar Chawla (pp.32-36,) is approximately 170 bushels, if the machines are working one hour continuously. The figure of 150 bushels/hour was recommended by the Engineering Division of the Alberta Department of Agriculture. The plants' capacity per eight-hour day is 1,200 bushels, and the annual capacity for 220 workdays, working one shift (8 hours) is 264,000 bushels, working two shifts (16 hours) is 528,000 bushels, and working three shifts (24 hours) is 792,000 bushels of seed.

**Plants with two indents should be able to increase their capacity by 25%. Their capacity is therefore 187 bushels per hour. The plants' annual capacity for 220 workdays, working one shift (8 hours) is 329,120 bushels, working two shifts (16 hours) is 658,240 bushels, and working three shifts (24 hours) is 987,360 bushels of seed.

Table B-11

SELECTED SMALL VOLUME PLANTS' SEED CLEANING MACHINERY AND CAPACITY (1970-1975)

Name of Plant	Machinery			Plants' Capacity Bushels/Hour
	Indent	Wind and Screen	Precision Grader	
Bentley	ST4B	CL #248DH	HC6	150*
Blackie	HEU	CL #248DH	HC6	150
Coronation	HEU #SG22	CL #248DH	-	150
Edgerton	ST4B	CL #248DH	-	150
Forestburg	HEU	CL	HC6	150
Gibbons	HEU #SG22	CL #248DH	-	150
Holden	HEU #SG22	CL #248DH	HC6	150
Medicine Hat	HEU #SG22	CL #248DH	HEU	150
Okotoks	ST4B	CL #248DH	-	150
Ponoka	ST4B	CL #248DH	HC6	150
Queenstown	HEU	CR	HC6	150
Rosebud	HEU #SG22	CL #248DH	HC6	150
Vegreville	ST4B	CR #M5472	-	150
Vulcan	ST4B	CR #M5472	SD	150
Warburg	HEU #SG22	CL #248DH	-	150
Delia	HEU #SG22	CR #M5472	HC6	150
High Prairie	HEU #SG22	CL #SG22	-	150

Legend for Manufacturing Companies

CL: Clipper
CR: Crippen
HC: Hart Carter
HEU: Hart Emerson Uniflo
SD: Simon Day
ST4: Superior Terminal Four

*See footnote * on Table B-10

Table B-12

RESERVES FOR THE SELECTED LARGE VOLUME ALBERTA CO-OPERATIVE SEED CLEANING PLANTS (1970-1975)

Name of Plant	1970		1971		1972		1973		1974		1975	
	Reserves*	Other Current Assets**	Reserves	Other Current Assets	Reserves	Other Current Assets	Reserves	Other Current Assets	Reserves	Other Current Assets	Reserves	Other Current Assets
Barrhead	25,363	10,575	35,229	4,713	36,789	6,867	--†	--	--	--	--	--
Beiseker	31,000	27,000	31,000	37,150	46,242	26,660	--	--	41,000	50,072	49,573	45,661
Boyle	20,000	4,333	5,000	1,849	0	9,519	--	--	4,477	1,895	9,175	3,014
Fairview	5,000	14,601	5,000	18,144	14,777	13,011	--	--	14,000	10,691	13,000	11,862
Falher	366	4,497	366	7,555	366	3,865	--	--	--	--	15,366	7,467
Innisfail	11,100	17,082	14,210	14,613	10,045	13,994	--	--	0	42,793	0	55,913
Nanton	19,533	18,853	19,480	22,906	33,376	16,339	--	--	--	--	43,232	29,959
Provost	45,000	28,312	45,000	31,504	56,231	19,364	--	--	62,864	22,842	63,702	24,369
Rycroft	--	--	20,794	16,740	29,746	10,170	--	--	20,570	26,160	20,570	18,382
Stony Plain	--	--	87,827	19,438	79,007	17,36[illegible]	--	--	--	--	--	--
Strathmore	26,050	28,049	16,050	30,635	16,050	37,10[illegible]	--	--	50	37,797	50	48,313
Grimshaw	8,396	6,267			9,369	8,927	--	--	24,535	3,336	24,125	9,879

* Reserves are the plants' investments which include bank savings accounts, term deposits, etc.

** Other current assets include cash, accounts receivable, inventories at cost, accrued interest receivable, and prepaid expenses.

† (--) Figures were not available.

Table B-13

RESERVES FOR THE SELECTED SMALL VOLUME ALBERTA CO-OPERATIVE SEED CLEANING PLANTS
(1970-1975)

Name of Plant	1970		1971		1972		1973		1974		1975	
	Reserves*	Other Current Assets**	Reserves	Other Current Assets	Reserves	Other Current Assets	Reserves	Other Current	Reserves	Other Current Assets	Reserves	Other Current Assets
Bentley	3,005	12,371	3,005	9,021	--	--	--	--	3,005	16,071	5	31,935
Blackie	--†	--	121	6,786	102	7,537	--	--	--	--	5,400	19,063
Coronation	13,339	7,797	15,285	14,791	19,847	16,012	--	--	32,000	19,566	47,872	14,236
Edgerton	5,300	9,488	2,173	8,351	12,483	7,812	--	--	20,000	15,838	0	36,335
Forestburg	13,000	12,931	13,000	13,740	18,720	15,455	--	--	--	--	11,471	33,420
Gibbons	1,308	19,775	5,389	11,530	5,767	3,119	--	--	5,306	12,790	5,306	9,737
Holden			12,836	27,334	14,183	17,065	--	--	--	--	--	--
Medicine Hat	12,052	13,260	12,052	20,312	15,052	22,980	--	--	35,096	12,619	28,096	22,224
Okotoks	4,000	8,797	5,000	9,080	--	8,274	--	--	--	--	9,000	10,375
Ponoka	3,000	6,603	3,000	7,712	3,030	9,325	--	--	3,000	12,367	8,028	12,865
Queenstown			24,786	9,014	24,711	10,490	--	--	--	--	43,000	9,028
Rosebud	28,749	11,327	11,693	12,913	20,630	9,743	--	--	10,000	27,460	18,000	27,274
Vegreville	21,207	8,481	21,315	10,918	21,789	8,076	--	--	--	--	--	--
Vulcan	25,732	23,995	4,103	46,480	32,641	19,071	--	--	27,128	14,584	--	--
Warburg	0	17,519	0	21,274	10,756	9,168	--	--	13,000	17,819	14,000	38,390
Delia	11,550	12,451	16,550	13,259	20,550	13,390	--	--	32,426	4,224	27,331	6,324
High Prairie	13,160	5,168	14,707	9,653	15,104	11,903	--	--	19,871	9,535	21,595	14,193

* Reserves are the plants' investments, which include bank savings account, term deposits, etc.

** Other current assets include cash, accounts receivable, inventories at cost, accrued interest receivable, and prepaid expenses.

† (--) Figures were not available.

Table B-14

NET EARNINGS FOR TWELVE SELECTED LARGE VOLUME ALBERTA CO-OPERATIVE SEED CLEANING PLANTS (1970-1975)

Plant Code	1970	1971	1972	1973	1974	1975
13	(445)*	2,407	4,372	1,135	(2,765)	1,404
55	1,930	4,172	6,221	9,520	9,695	1,824
12	--**	--	664	0	(7,104)	3,035
04	(6,264)	2,833	1,252	3,435	(4,048)	1,063
07	--	0	0	0	0	18,316
49	2,282	4,777	3,426	1,908	6,752	10,629
62	3,793	4,837	4,680	6,147	3,742	--
41	--	4,400	2,445	12,330	9,432	6,956
06	--	0	0	0	1,805	(674)
26	5,924	7,050	3,585	213	4,979	--
58	848	997	--	--	6,862	(4,162)
02	--	0	0	1,216	209	--

* Figures in parentheses represent a loss.

** Figures missing.

Source: Annual Financial Statements of Alberta Seed Cleaning Co-operative Plants, 1970-75.

Table B-15

NET EARNINGS FOR SEVENTEEN SELECTED SMALL VOLUME ALBERTA CO-OPERATIVE SEED CLEANING PLANTS (1970-1975)

Plant Code	1970	1971	1972	1973	1974	1975
48	2,141	2,608	--*	(1,539)**	4,028	7,242
60	(86)	(1,576)	--	--	414	2,839
45	--	(2,363)	4,147	3,672	4,005	3,028
40	--	(200)	--	--	2,458	(3,242)
43	--	1,584	2,814	7	3,661	3,227
19	--	--	(1,661)	1,014	1,620	--
32	665	5,070	(350)	(1,056)	--	--
72	(2,033)	2,254	1,861	1,216	4,541	3,168
59	(1,313)	(271)	(4,070)	(1,414	6,521	1,975
41	(6,075)	(2,028)	(3,029)	(4,174)	5,662	4,218
61	--	--	813	1,113	3,110	472
56	3,716	(505)	2,027	488	8,363	2,309
28	167	523	(1,478	480	--	--
63	5,403	2,648	1,191	6,023	566	--
34	1,515	(420)	(2,720)	2,975	1	222
52	--	--	581	1,116	(218)	2,725.
08	--	3,740	0	177	0	(2,464)

* Figures missing.

** Figures in parentheses represent a loss.

Source: Annual Financial Statements of Alberta Seed Cleaning Co-operative Plants, 1970-75.

Table B-16

SHARE CAPITAL AND DEPRECIATION FOR 29 SELECTED ALBERTA PLANTS, 1970 - 1975

Plant	Share Capital						Depreciation					
	1970	1971	1972	1973	1974	1975	1970	1971	1972	1973	1974	1975
Barrhead	19,029	19,054	19,429	--	22,139	--	2,645	--	2,159	2,239	3,943	--
Belseker	15,800	16,150	16,150	15,800	15,800	--	2,736	--	2,259	2,795	2,377	--
Boyle	--	22,805	23,155	--	23,900	23,150	--	--	1,644	--	4,527	5,312
Fairview	17,850	18,150	18,000	--	--	--	4,210	--	3,033	--	--	--
Falher	21,350	21,350	21,400	--	22,200	22,650	--	--	--	11,183	--	10,405
Innisfail	17,800	17,750	17,550	17,750	18,300	--	3,591	--	3,127	--	--	--
Nanton	17,700	18,000	18,100	--	18,900	19,600	5,616	--	3,000	3,178	3,072	4,339
Provost	14,700	14,950	15,050	--	--	1,500	2,952	--	2,556	--	--	3,529
Rycroft	--	16,960	16,561	--	25,350	26,100	--	--	3,110	--	3,298	3,316
Stony Plain	--	15,250	15,400	15,475	15,375	--	--	--	1,415	704	3,211	--
Strathmore	16,200	16,200	15,150	35,150	35,150	--	3,373	3,909	3,078	2,847	2,415	--
Grimshaw	17,850	--	50,150	--	--	16,750	3,118	--	483	--	--	4,498
Bentley	17,450	18,000	--	--	--	--	--	--	--	--	--	--
Blackie	21,700	19,973	21,900	--	--	--	1,456	2,943	5,291	--	--	--
Coronation	20,800	20,650	20,900	--	--	--	250	4,104	4,826	--	--	--
Edgerton	24,764	26,111	27,039	--	--	--	2,666	2,671	3,493	--	--	--
Forestburg	20,250	19,800	20,500	--	--	--	2,054	--	3,005	--	--	--
Gibbons	18,200	18,450	18,650	--	--	--	4,773	--	--	--	--	--
Holden	--	15,625	19,475	--	--	--	2,881	--	2,376	--	--	--
Medicine Hat	20,450	21,450	20,850	--	--	--	4,130	5,228	4,414	--	--	--
Okotoks	16,650	16,850	16,868	--	--	--	3,022	1,576	2,502	--	--	--
Ponoka	17,700	17,650	17,350	--	--	--	4,130	4,130	4,130	--	--	--
Queenstown	--	17,100	16,500	--	--	--	--	--	2,763	--	--	--
Rosebud	12,550	13,225	13,450	--	--	--	1,777	--	2,847	--	--	--
Vegreville	15,700	16,250	17,825	--	--	--	835	--	839	--	--	--
Vulcan	14,550	14,450	14,550	--	13,950	--	1,845	1,748	2,206	3,649	2,428	--
Warburg	--	18,600	18,600	--	18,650	19,300	--	--	3,239	2,552	2,946	5,330
Delia	18,800	18,600	18,250	--	--	18,700	3,383	--	3,256	--	2,985	6,221
High Prairie	23,600	23,500	23,400	--	--	20,900	--	--	5,226	--	--	6,631

Note: (--) indicates data not available.

Source: Seed Cleaning Plants' Annual Financial Reports.