AN ECONOMIC ANALYSIS OF THE NUMBER AND SIZE OF COOPERATIVE GRAIN ELEVATORS IN KANSAS, 1950 TO 1980

by

CLEMENT E. WARD

B. S., Iowa State University of Science and Technology, 1966

A MASTER'S THESIS

submitted in partial fulfillment of the

requirements for the degree

MASTER OF SCIENCE

Department of Economics

KANSAS STATE UNIVERSITY
Manhattan, Kansas

1971

Approved by:

Milton K. Manuel
Major Professor

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ACKNOWLEDGEMENTS

The author would like to express his sincere appreciation for the patience of and capable assistance given by his major professor, Dr. Milton Manuel. Dr. Manuel's suggestions, questions and encouraging comments were most helpful throughout the preparation of this paper. Also supplying helpful comments were Dr.'s John Nordin and Leonard Schruben, members of the author's supervisory committee.

An expression of gratitude must also be directed to Mrs. John Angell and other typists in the Marketing Office within the Department of Economics for typing earlier drafts of this work. Finally the author wishes to thank Mrs. Linda Spielman and Mrs. Diana Luhman for quickly and ably typing the final manuscript.

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CHAPTER I

INTRODUCTION

Expanding population numbers and rising per capita incomes have contributed to increased domestic and foreign demand for food and feed grains during the past two decades. In addition there has been a growing concern for the quality and quantity of food being consumed. The trend established by these factors probably will continue during the present decade thus creating a favorable situation for further growth in demand for feed and food grains.

Also as in the past it appears the United States will be a substantial provider of the world's grain supply. During the 1950's and 1960's total annual grain production in Kansas rose and according to a recent study Kansas will provide an even larger percentage of the total United States grain supply.[1] Thus the demand situation for Kansas grain producers is also favorable.

Just as the total production of grain in Kansas has increased the percentage of grain which is marketed has also increased; from 68.1 percent in 1950, to 75.9 percent in 1960, to 82.2 percent in 1969.[2] Due

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[1]Orlan H. Buller, et al., Kansas Agriculture and Agribusiness in 1980, Research Paper No. 3 (Manhattan, Kansas: Kansas Agricultural Experiment Station, May, 1971.)

[2]Percentage of grain marketed is used in this paper synonymously with off-farm grain sales and refers to that portion of the total annual grain production which leaves the farm on which it was produced. Included in off-farm grain sales is grain sold to elevators, processors and other livestock feeders; not included in off-farm grain sales is grain fed by the producer or stored at the production site. Percentage of off-farm grain sales for

to the recent rapid expansion in cattle feedlot operations, many of which depend on other producers for a substantial portion of their grain supply, the percentage of off-farm grain sales may continue to increase in the 1970's. More will be mentioned concerning this in a later section.

Country grain elevators perform such major marketing functions as assembling, storing and merchandising Kansas produced grain. The country grain elevator industry will provide the same key role in the marketing process as it has in the past if the assumptions concerning grain production and percentage of off-farm grain sales are correct.

Both producers and consumers are concerned with prices of food and feed grains and related products. Since these prices are directly affected by the costs of doing business it is worthwhile to consider how well, in terms of least costs, the industry is performing its marketing functions.

Objectives

This study examined the industry in terms of least costs and projected for 1980 how the cooperative subsector would be performing its grain handling role.

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each year was calculated as follows:

$$Z = \frac{\sum_{i=1}^{7} a_i X_i}{\sum_{i=1}^{7} X_i}$$

$i = 1, \ldots, 7$

X = Grains; (1) wheat, (2) grain sorghum, (3) corn, (4) soybeans, (5) oats, (6) barley and (7) rye.

a = Percentage of off-farm grain sales; each grain. Source: Kansas State Crop and Livestock Reporting Service, Topeka, Kansas.

Z = Percentage of off-farm grain sales; all grains.

Specifically the objectives are:

a. Determine and analyze changes in number and size of country grain elevators in Kansas for the years 1950, 1960 and 1969.

b. Determine how well the industry is performing its grain handling function by comparing data on the number and size of country grain elevators and their volume handled with relevant cost-volume studies.

c. Estimate an economical number and size of cooperatively owned country grain elevators for Kansas in 1980.

d. Assist cooperative elevator managers and decision makers in planning more efficient grain handling operations.

Data Sources

The data for this study came primarily from the Kansas Grain and Feed Dealers Association's Official Directory for 1950, 1960 and 1969. This is a biennially printed trade association publication listing country elevators, terminal elevators, flour and feed mills, alfalfa, grain and seed processors, commission agents and grain brokerage firms in Kansas. Additional information is included about each grain elevator and processing plant, such as the storage capacity, number of plants, processing capacity and lines of products handled.

Another source of data was a ten percent sample interview survey taken in 1955, 1961 and 1968 in Kansas. The random sample was stratified by crop reporting districts and was found to be representative of the state population as well as within each district.[3] Other sources of data included the Kansas

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[3]For a more complete discussion see; Don D. Pretzer, "The Organization of Country Elevators in Kansas." (Unpublished M.S. thesis, Kansas State University, 1970), pp. 23-36.

State Statistician's Office, USDA Crop and Livestock Reporting Service, USDA Farmer Cooperative Service and other data published by the Kansas State University Experiment Station.

CHAPTER II

REVIEW OF RELEVANT COST-VOLUME STUDIES

Three studies which have been conducted in the Midwest relate costs of handling grain to volume handled. The portion of these studies relevant to this paper will be reviewed below.

Cost-Volume Study in Wheat Belt, 1955

Hall's study showed the relationship between costs and volume of handling small grain in the hard winter wheat belt.[4] His study was conducted to assist elevator operators meet the increased demand for elevator modernization in the most efficient manner. General guides were developed by using simulated elevators of a modern design.

Several firms of a specific size and type were selected for field observation during the four seasons in 1950-51 and audited records were used from nearly 250 Kansas elevators. From this information costs were developed as accurately as possible for several country elevator models and were analyzed. Costs were allocated by functions with grain handling considered to be the primary function. Each of the five models considered was of a standard design and for each model a maximum practical volume limitation and annual average turnover were determined. (See Table 1)

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[4] U.S., Department of Agriculture, Farmer Cooperative Service, New Local Elevators, Costs-Volume Relations in the Hard Winter Wheat Belt, by Thomas E. Hall et al., Service Report No. 12, (Washington, D. C.; Government Printing Office, May, 1955).

Table 1. Model size, maximum practical volume limitation and annual average turnover for each model used in Halls's study.[a]

Model Plant Size (bushels)	20,000	100,000	200,000	300,000	600,000
Maximum Practical Volume Limitation (bushels)	250,000	400,000	600,000	900,000	1,500,000
Annual Average Turnover	12.5	4.0	3.0	3.0	2.5

[a]See Footnote Number 4.

Hall considered two points to be of major importance concerning grain volume. One was the practical maximum limitations on volume that can be handled through a given size elevator. The second point was that different volume levels used in the models were presumed to be those that local management would consider as average at their building location. The maximum practical volume level was defined by Hall as: "...the practical maximum annual volume is what can be received during the wheat harvest, plus whatever is available for market later in the year from farm storage and from other grains with a different harvest season."[5] Limitations in volume may be caused by one or several factors: size and number of elevator legs, number of truck scales and receiving dumps, number of cars which can be spotted for loading daily, siding for empty and loaded boxcars, total capacity of the elevator and total on-farm storage capacity.

Turnover shows the number of times a plant of a given size handles a quantity of grain equal to its rated storage capacity. Turnover includes both peak harvest periods when a relatively large volume of grain is handled in a short time span and non-harvest periods when a relatively

[5]Ibid., p. 13.

small volume of grain is handled over a much longer time span. Thus, turnover is an annual average and may be thought of as a uniform movement of grain through an elevator over a 12 month period though this is a simplification. Turnover, of course, decreases as one or more factors limit total annual volume handled.

Table 1 shows turnover at the maximum practical volume limitation for each model plant. For the 20,000 bushel model plant, a turnover of 12.5 may seem unreasonably high. Two possible explanations are given: (1) During the late 1940's and early 1950's there was much less grain stored on farms than in the 1960's so grain was marketed largely during peak harvest times. (2) Many more line elevators which were owned and operated by large grain marketing or milling firms were in operation. Small line elevators acted as buying stations or assemblers for larger terminal storage or processing plants and were not operated to store grain for extended periods of time. A 12.5 turnover, then, in 1950, may not have been unreasonable though it was not a typical level. A turnover of 12.5 in 1960 or later years probably would be unrealistically high.

Hall found the cost of handling grain was nearly two and one-half cents per bushel less for the 600,000 bushel plant compared to the 20,000 bushel plant when both operated at the maximum volume limitations. For a given volume, the smallest plant capable of handling that volume will have the lowest per unit cost. Thus cost per unit decreases as turnover increases.

Given a fixed cost per bushel larger plants will need to handle a larger volume but at a smaller turnover than smaller plants. Therefore a larger elevator can compete with a smaller elevator over a greater

range of volumes. Each elevator of a given size operates at lowest per unit cost when volume equals its maximum practical scale.

Hall also investigated using a new elevator in conjunction with the older facility versus using the new elevator by itself. As might be expected by using the new and old elevator together a larger volume must be handled to achieve the same level of per unit cost as the new facility would have to handle if operated alone.

Cost-Volume Study in Corn Belt, 1957

Thurston, as Hall, analyzed the cost and volume relations in handling feed grains.[6] His approach was similar to Hall's procedure but was conducted in the corn belt. Case studies from cooperatively owned elevators in Illinois were used to develop operating costs for synthetic elevator models. Cost figures for 1956 were used and were budgeted to three functions with grain handling again being considered the primary function.

For each model a base volume was established which was representative of the volume handled by that size and type of elevator in Central Illinois. Turnover was figured from the model size and base handling volume. (See Table 2).

Thurston's study also found per unit handling cost decreased as volume increased. For a given volume handled a smaller plant had a lower per unit cost thus again indicating a decrease in per unit cost as turnover increases. As had Hall, Thurston determined that in order

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[6] U.S., Department of Agriculture, Farmer Cooperative Service, Cost-Volume Relationships for New Country Elevators in the Corn Belt, by Stanley K. Thurston and R. J. Mutti, Service Report No. 32, (Washington, D. C., Government Printing Office, September, 1957).

to attain a given cost per unit the larger plants must handle a greater total volume of grain but may have a lower turnover.

Table 2. Model descriptions, sizes, base volumes and turnover for Thurston's study.[a]

Model Description	Rated Capacity (bushels)	Base Handling Volume (bushels)	Turnover
Old 30,000 bu elevator	30,000	200,000	6.7
New 30,000 bu elevator	30,000	200,000	6.7
Old 30,000 bu + two 20,000 bu concrete tanks	70,000	300,000	4.3
Old 30,000 bu + four 25,000 bu concrete tanks	130,000	400,000	3.1
Old 30,000 bu + 60,000 bu concrete	90,000	500,000	5.6
Old 30,000 bu + 100,000 bu concrete	130,000	600,000	4.6
Old 30,000 bu + two 55,000 bu flat	140,000	300,000	2.1
Old 30,000 bu + 200,000 bu concrete	230,000	800,000	3.5
Old 30,000 bu + 400,000 bu concrete	430,000	1,000,000	2.3

[a]See Footnote Number 5.

At the base volume levels assumed larger facilities had lower per unit costs even though turnover figures were lower at that volume. When operating at one-half the base volume levels larger plants had an even greater absolute cost advantage.

Optimum Number and Size of Elevators in Kansas, 1969.

Using the economic engineering approach Fuller developed LAC functions for five model elevators each handling three volume levels of grain.[7]

[7]Stephen W. Fuller, "The Optimum Number and Size of Country Grain Elevators in Spatial Equilibrium." (Unpublished Ph.D. dissertation, Kansas State University, 1970)

Model plant sizes used by Fuller were: 100,000 bu, 200,000 bu, 300,000 bu, 600,000 bu, and 1,000,000 bu. When developing his three LAC curves he assumed these plants handled one of three volumes of grain; equal to, twice and three times the rated storage capacity.

Fuller's LAC functions indicated economies of size were present over the entire range of plant sizes used in his study. As might be expected these economies are more pronounced among smaller plant sizes rather than larger sized plants. As was found in previously discussed studies cost per unit decreased as turnover increased. Fuller's results showed that a smaller plant operating at a relatively high turnover may have lower per unit costs than a large plant operating with less than optimum volume.

Besides developing plant cost functions Fuller derived an assembly cost function for each of what was found to be the four most common truck sizes used to deliver grain to country elevators. Each assembly cost function was then weighted by the volume of grain each truck size delivered to obtain the weighted assembly cost function.

The primary factors influencing assembly costs are density of production and distance grain must be transported from farm to elevator. As total production per a given area increases a smaller supply region is needed to assemble a given quantity of grain and assembly costs decrease. The converse is true also. As can then be seen the distance grain must be hauled causes the cost of assembly to vary.

Fuller's objective was to minimize combined plant costs and assembly costs and arrive at an optimum number and size of country grain elevators in Kansas. He arrived at a least-cost volume of grain necessary per

county and then estimated the required plant size. An optimum number and size of country grain elevators was determined and will be discussed in a later section.

CHAPTER III

NUMBER AND SIZE OF ELEVATORS IN 1950

In this section number and size of elevators operating in 1950 will be presented. Information was divided into cooperative and non-cooperative forms of ownership, compiled by crop reporting districts and then summarized for the entire state. When feasible findings were related to previously discussed cost studies.

Data on number and size of elevators vary greatly. Problems arise in using such terms as elevator, plant, firm, country and terminal.

In this paper an elevator is synonymous with a plant and refers to one physical facility at one site. An elevator normally consists of an elevator leg and a headhouse. Because two or more plants may be licensed to store grain as a single unit the number of licensed elevators understates the actual number of physical facilities. A firm may be one plant or several plants under the same ownership. Number of elevator firms is even smaller than number of licensed elevators in the state. Problems arise when firm and elevator or firm and plant are used synonymously.

Information is collected via samply survey on commercial grain storage by the Kansas State Crop and Livestock Reporting Service.[8] Storage capacity includes facilities licensed to store grain under the Uniform Grain Storage Agreement. Each year the Kansas State Crop and Livestock Reporting Service compares elevator numbers and

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[8]J.E. Pallesen, telephone interview, Statistical Reporting Service, USDA, Topeka, Kansas. June, 1971.

capacity with the Commodity Credit Corporation.

Two or more physically separated elevators located at the same site and under common ownership may be licensed as a single unit. One or more elevators of this type may not be licensed to store grain if it is used only during peak volume times each year.

Data for this study include both licensed and non-licensed country grain elevators. Therefore, elevator numbers may appear to be larger than as stated elsewhere but are believed to be an accurate count of physical facilities. Total capacity in this study also may be licensed or non-licensed but may be less than stated elsewhere because only upright storage was included.

Pallesen indicated it was difficult to distinguish between country and terminal elevators.[9] Though the Kansas State Crop and Livestock Reporting Service does not distinguish between the two types, approximately 60 of the larger elevators are surveyed individually rather than with the sample survey.

Information is received annually by the Kansas Grain and Feed Dealers Association from each elevator in Kansas.[10] Their official directory lists terminal elevators and Cranor defines them as elevators capable of placing official weights and grades on grain. Elevator numbers in this study include only country elevators.

Therefore, plant numbers in this study may be larger and storage capacity may be smaller than found elsewhere. As a result average plant size may be understated and turnover overstated when compared

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[9] Ibid.

[10] John Cranor, telephone interview, President, Kansas Grain and Feed Dealers Association, Hutchinson, Kansas. June, 1971.

with other published figures. Conclusions drawn from this study are not believed to be affected significantly by the variation in data used in this study compared with similar data used in other studies.

Data on number and capacity of country grain elevators were compiled from the Kansas Official Directory for 1950, 1960, and 1969. (See Selected Bibliography). After compiling number and capacity data, average plant size was calculated by dividing total capacity by the number of elevators. Average plant size was figured for each crop reporting district and the state as a whole and by type of business organization, cooperative and non-cooperative. Average plant size was multiplied by average annual turnover, to arrive at the average annual volume of grain handled per plant.

Turnover was determined by dividing total off-farm grain sales by total grain elevator capacity for a given geographic region. As was stated earlier, turnover is an average annual figure thus assumes a uniform movement of grain to and from an elevator throughout the year. This is an over-simplification because plants handle relatively more grain during harvest periods than during the remainder of the year. Turnover was figured for a geographic region but could not be figured by type of business organization. Therefore, turnover was assumed to be uniform over a given geographic area and for both subsectors.

Two subsectors, cooperative and non-cooperative, were assumed in this paper. The term subsector was used to group all cooperatively owned elevators together and distinguish them from all elevators under a different type of ownership.

In 1950 (See Table 3) there were 1,642 country grain elevators in Kansas with a total capacity of 71.653 million bushels. Kansas farmers marketed 68.1 percent of the 344.9 million bushels of grain produced.[11] Total annual production included production of seven grains; wheat, grain sorghum, corn, soybeans, oats, barley and rye. Not all 234.8 million bushels was handled by country elevators; however, the amount of grain by-passing country elevators was believed to be small and has been disregarded for 1950. From above figures average plant size for the state in 1950 was determined, 43,638 bushels. Turnover was 3.3 so an average size plant handled 142,993 bushels of grain.

Maximum practical volume limitation for the 20,000 bushel model plant was 250,000 bushels so its turnover was 12.5. Comparable figures for the 100,000 bushel model plant were 400,000 bushels and a turnover of four. Grain elevators in 1950, could have reduced per unit handling costs had each plant handled a larger volume of grain or in other words had there been a larger turnover.

Using average plant size statistics, it appears elevators throughout the state could have had lower per unit handling costs. Elevators in certain crop reporting districts; northeast, east-central and southeast, were operating relatively efficiently. In these districts elevators had average plant sizes of less than 25,000 bushels with turnovers of approximately eight to twelve times, thus were operating close to their maximum volume limitations. Elevators in the remaining districts had larger average plants but

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[11] Kansas State Board of Agriculture, Report at the Board, Farm Facts, 1950. (Topeka, Kansas: Ferd Voiland Jr. State Printer, 1951).

Table 3. Number and size of country elevators, average plant size, turnover, and volume handled per elevator, by crop reporting district and by type of business organization, Kansas, 1950.

Crop Reporting District	Number	Total Capacity (1,000 bushels)	Average Plant Size (bushels)	Turnover	Average Volume Handled Per Plant (bushels)
Northwest					
Cooperative	30	1,760	58,667	4.3	253,981
Non-Cooperative	99	4,125	41,667	4.3	180,385
Total	129	5,885	45,620	4.3	197,498
West-Central					
Cooperative	25	1,375	55,000	2.9	159,880
Non-Cooperative	101	4,534	44,891	2.9	130,494
Total	126	5,909	46,897	2.9	136,325
Southwest					
Cooperative	60	9,539	158,983	1.0	166,010
Non-Cooperative	149	11,297	75,819	1.0	79,170
Total	209	20,836	99,694	1.0	104,100
North-Central					
Cooperative	58	2,737	47,190	1.5	71,804
Non-Cooperative	165	5,004	30,327	1.5	46,146
Total	223	7,741	34,713	1.5	52,819
Central					
Cooperative	70	3,870	55,286	2.6	146,364
Non-Cooperative	202	8,208	40,634	2.6	107,574
Total	272	12,078	44,404	2.6	117,555
South-Central					
Cooperative	77	5,661	73,519	3.6	264,205
Non-Cooperative	272	6,774	24,904	3.6	89,498
Total	349	12,435	35,630	3.6	128,044
Northeast					
Cooperative	30	765	25,500	7.9	200,616
Non-Cooperative	86	1,761	20,477	7.9	161,099
Total	116	2,526	21,776	7.9	171,318
East-Central					
Cooperative	17	396	23,294	9.4	218,607
Non-Cooperative	83	2,001	24,108	9.4	226,246
Total	100	2,397	23,970	9.4	224,951

Southeast					
Cooperative	25	297	11,880	12.4	147,472
Non-Cooperative	93	1,549	16,656	12.4	206,899
Total	118	1,846	15,644	12.4	194,328
State Totals					
Cooperative	392	26,400	67,347	3.3	220,682
Non-Cooperative	1,250	45,253	36,202	3.3	118,627
Total	1,642	71,653	43,638	3.3	142,993

had lower turnovers and, consequently, had higher per unit handling costs.

All nine districts had fewer cooperative elevators than non-cooperative plants and less cooperative capacity than non-cooperative capacity. Of the total number of plants, 392 or 23.9 percent were cooperatively owned. The percentage of total capacity accounted for by cooperatives was larger, 36.8 percent or 26.4 million bushels. Thus for the entire state average size cooperative plants were larger. Examining each district it was found average size cooperative plants were larger in seven of the nine districts. The exceptions were in the east-central and southeast districts.

Turnover, as was stated earlier, was assumed to be uniform for a given geographic area and for both cooperative and non-cooperative subsectors. Therefore the subsector in a given geographic area which had the largest average plant size also handled the largest volume of grain per plant. For the entire state and seven of the nine districts the cooperative subsector was handling the largest volume of grain per plant. In these districts cooperative plants were handling grain at a lower cost per unit than non cooperative plants, assuming turnover was the same for each subsector.

CHAPTER IV

NUMBER AND SIZE OF ELEVATORS IN 1960

Between 1950 and 1960 many changes occurred which affected the Kansas country grain elevator industry. Certain government actions encouraged storage construction such as the Occupancy Guarantee Contracts in 1953-54 which provided a minimum income from government storage contracts. A policy change causing an increase in storage construction was in the Internal Revenue Code. The change provided for a more rapid depreciation of new facilities during the period 1952 to 1956. In addition storage rates rose and attracted new construction. As transportation and harvesting techniques improved and production increased elevators were forced to handle a larger volume of grain in a shorter period of time, also influencing new construction. Much of the construction of storage facilities came in the form of new plants which increased total number as well as total capacity of elevators in Kansas.

From 1950 to 1960 total annual grain production in Kansas increased by 72.9 percent, from 344.9 to 596.4 million bushels.[12] While production increased, percentage of grain being marketed also rose from 68.1 percent to 75.9 percent. As a result nearly twice as much grain was marketed in 1960 as in 1950, 452.6 and 234.8 million bushels respectively. Though the western one-third of Kansas accounted for a larger increase in grain marketed the eastern one-third had a larger percentage increase in total capacity.

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[12]Kansas State Board of Agriculture, Report of the Board, Farm Facts, 1960-1961. (Topeka, Kansas: State Printing Plant, 1961).

Total numbers of country grain elevators rose by eight percent during the 1950's from 1,642 to 1,782 plants. (See Table 4) Though number of plants increased total capacity for the state increased by a considerably larger percentage. Total capacity increased from 71.653 million bushels to 292.086 million bushels or an increase of 307.6 percent.

Because total capacity grew at a more rapid rate than did total volume of grain marketed average annual turnover for the state was reduced from 3.3 in 1950 to 1.5 in 1960. The large increase in capacity of country grain elevators compared to the relatively small increase in number of plants caused average plant size to increase from 43,638 to 163,909 bushels per plant.

Increased plant size combined with decreased turnover caused the average volume of grain handled per plant to increase by 77.6 percent, from 142,993 to 254,026 bushels.

As in 1950, highest turnovers were found in districts comprising the eastern one-third of Kansas. These ranged from approximately 2.4 to 3.4 so were considerably lower than comparable figures for 1950. Again plants in the western one-third had the largest average plant size and surpassed the eastern one-third for the largest average volume handled per plant. Average plant size in the eastern one-third was again the smallest of the three subdivisions of the state.

Considering average plant size and turnover, average size plants in none of the districts were operating at their base handling volume or maximum volume limitation. Thus it may be concluded that the industry in 1960 just as in 1950 was not handling grain at lowest possible cost per unit.

Table 4. Number and size of country elevators, average plant size, turnover and volume handled per elevator, by crop reporting district and by type of business organization, Kansas, 1960.

Crop Reporting District	Number	Total Capacity (1,000 bushels)	Average Plant Size (bushels)	Turnover	Average Volume Handled Per Plant (bushels)
Northwest					
Cooperative	43	10,558	245,535	1.9	459,273
Non-Cooperative	103	13,700	133,010	1.9	248,795
Total	146	24,258	166,151	1.9	310,785
West-Central					
Cooperative	34	12,791	376,206	1.6	597,942
Non-Cooperative	107	18,788	175,589	1.6	279,081
Total	141	31,579	223,965	1.6	355,970
Southwest					
Cooperative	69	34,215	495,870	1.3	636,052
Non-Cooperative	132	39,276	221,788	1.3	284,487
Total	201	63,491	315,876	1.3	405,174
North-Central					
Cooperative	78	15,027	192,654	1.6	310,944
Non-Cooperative	149	15,479	103,886	1.6	167,672
Total	227	30,506	134,388	1.6	216,902
Central					
Cooperative	106	22,697	214,123	1.2	251,637
Non-Cooperative	175	20,273	115,846	1.2	136,142
Total	281	42,970	152,918	1.2	179,709
South-Central					
Cooperative	121	38,167	319,430	1.2	382,743
Non-Cooperative	235	21,772	92,647	1.2	112,418
Total	356	59,939	168,368	1.2	204,298
Northeast					
Cooperative	34	4,617	135,794	2.9	390,136
Non-Cooperative	98	6,808	69,469	2.9	199,584
Total	132	11,425	86,553	2.9	248,667
East-Central					
Cooperative	23	2,543	110,565	2.4	264,570
Non-Cooperative	123	13,175	107,114	2.4	149,199
Total	146	15,718	107,658	2.4	257,615

Southeast					
Cooperative	37	2,358	63,730	3.4	216,319
Non-Cooperative	115	9,842	85,583	3.4	290,494
Total	152	12,200	80,263	3.4	272,437
State Totals					
Cooperative	545	142,973	262,336	1.5	406,568
Non-Cooperative	1,237	139,113	120,544	1.5	186,819
Total	1,782	292,086	163,909	1.5	254,026

Both average plant size and turnover increased in two districts, southwest and north-central. Average size plants in these districts more closely approached their base handling volume and maximum volume limitation hence lowered handling costs per unit from 1950 to 1960. Even though handling volume increased it is difficult to determine whether average size plants in the remaining districts lowered handling costs.

Looking at the cooperative subsector it was found that in 1960 as in 1950 all nine districts and the state as a whole had more non-cooperative than cooperative plants. Unlike 1950, three districts; southwest, central and south-central, each had a greater total capacity for cooperative plants than non-cooperative plants. In eight of the nine districts and for the entire state average plant size for cooperatives was greater than for non-cooperative plants. Thus average plant size for cooperatives surpassed the average plant size for non-cooperative plants in one district, east-central, between 1950 and 1960. The one exception where non-cooperative average plant size was larger than cooperative average plant size was the southeast district.

Cooperative plant numbers increased relative to total plant numbers during the 1950's. Of the 1,782 plants in Kansas as of 1960, 545

or 30.6 percent were cooperatively owned. This compares with 392 and 23.9 percent respectively for 1950. Total capacity for cooperatives increased even faster. Total cooperative capacity in 1960 was 142.973 million bushels or 49.0 percent of the state total. Comparable figures for 1950 were 26.400 million bushels and 36.9 percent. Average plant size of cooperative elevators increased both relatively and absolutely more than non-cooperative elevators during this period.

As in 1950, turnover was assumed to be uniform for a given geographic area. Therefore, plants having the largest average size had lowest costs per unit. For the entire state and eight of nine districts average size cooperative plants were larger than non-cooperative plants. Thus in 1960 as was found in 1950 the cooperative subsector was handling grain at a lower cost per unit than the non-cooperative subsector assuming turnover was the same for each subsector. The percentage increase in average plant size was greater in the cooperative subsector than was the comparable percentage increase in the non-cooperative subsector. Therefore, the cooperative subsector reduced its per unit handling costs relatively more than the non-cooperative subsector between 1950 and 1960.

CHAPTER V

NUMBER AND SIZE OF ELEVATORS IN 1969

Between 1960 and 1969 a major agricultural policy change significantly affected the Kansas country grain elevator industry. Government grain storage as a primary source of income to elevator firms declined in importance because government owned grain reserves were reduced substantially. The flour milling industry declined in relative importance and some pre-World War II built plants were phased out of operation during this period. The 1960's also saw an increase in frequency of mergers, acquisitions, and business consolidations.

The above contributed to a decline in elevator numbers during the 1960's. Though numbers declined total capacity increased as a result of further increases in production and marketed grain. The rate of capacity expansion; however, was considerably below that of the previous decade.

Total annual grain production in Kansas increased 2.7 percent from 1960 to 1969. Total annual grain production in 1969, 612.6 million bushels, was 77.6 percent larger than in 1950.[13] Percentage of grain marketed rose from 75.9 percent in 1960 to 82.2 percent in 1969. Volume of off-farm grain sales in 1969 was 11.2 percent greater than in 1960 and 114.4 percent greater than in 1950.

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[13]Kansas State Board of Agriculture, Report of the Board, Farm Facts, 1969-1970. (Topeka, Kansas: Robert R. Sanders, State Printer, 1970).

A total of 1,535 elevators handled the increased volume of marketed grain. (See Table 5) Thus elevator numbers declined by 247 plants or 13.9 percent since 1960 and by 107 or 6.5 percent since 1950. Total capacity increased 10.7 percent from 1960 but was far below the percentage change between 1950 and 1960. Total capacity, 323.221 million bushels was 351.1 percent larger in 1969 than in 1950.

Table 5. Number and size of country elevators, average plant size, turnover and volume handled per elevator, by crop reporting district and by type of business organization, Kansas, 1969.

Crop Reporting District	Number	Total Capacity (1,000 bushels)	Average Plant Size (bushels)	Turnover	Average Volume Handled Per Plant (bushels)
Northwest					
Cooperative	38	11,060	291,053	1.6	461,668
Non-Cooperative	87	13,847	159,161	1.6	252,461
Total	125	24,907	199,256	1.6	316,060
West-Central					
Cooperative	33	14,820	449,091	1.2	558,669
Non-Cooperative	75	20,697	275,960	1.2	343,294
Total	108	35,517	328,861	1.2	409,103
Southwest					
Cooperative	73	38,894	532,795	1.3	701,531
Non-Cooperative	98	27,239	277,949	1.3	365,975
Total	171	66,133	386,743	1.3	509,225
North-Central					
Cooperative	72	15,610	216,806	1.8	394,413
Non-Cooperative	127	19,943	157,031	1.8	285,671
Total	199	35,553	178,658	1.8	325,015
Central					
Cooperative	106	24,325	229,481	1.1	254,678
Non-Cooperative	142	26,210	184,577	1.1	204,844
Total	248	50,535	203,770	1.1	226,144
South-Central					
Cooperative	126	40,792	323,746	1.3	427,409
Non-Cooperative	159	23,632	148,629	1.3	196,220
Total	285	64,424	226,049	1.3	298,430

Northeast					
Cooperative	46	8,463	183,978	2.1	384,238
Non-Cooperative	73	13,729	188,068	2.1	390,899
Total	119	22,192	186,487	2.1	389,478
East-Central					
Cooperative	25	4,018	160,720	3.2	521,504
Non-Cooperative	100	8,790	87,900	3.2	285,217
Total	125	12,808	102,464	3.2	332,475
Southeast					
Cooperative	43	4,597	106,907	3.3	355,327
Non-Cooperative	112	6,555	58,527	3.3	194,526
Total	155	11,152	71,948	3.3	239,134
State Totals					
Cooperative	562	162,579	289,319	1.6	450,499
Non-Cooperative	973	160,642	165,100	1.6	237,077
Total	1,535	323,221	210,567	1.6	327,874

Percentage increase in grain marketed, 11.2, and percentage increase in total capacity, 10.7, were not greatly different. Therefore, average annual turnover in 1969 was only slightly changed from that of 1960, 1.6 and 1.5 respectively.

Due to declining elevator numbers and increasing capacity average plant size again was increased. The 28.5 percent increase in average plant size, to 210,567 bushels, along with a slightly higher turnover caused volume of grain handled per plant to be increased to 327,874 bushels, a 29.1 percent increase. Since 1950 average plant size increased 382.5 percent and volume handled per plant increased 129.3 percent.

As was found in 1950 and 1960 elevators in the eastern one-third of Kansas again had the smallest average plant size and largest turnover in 1969. Elevators in the western one-third had the largest average plant size and largest volume of grain handled per plant.

Between 1960 and 1969 turnover increased in the southwest and north-central districts. These were the only districts where average

annual turnover increased for both 1950 to 1960 and 1960 to 1969. During the 1960's plants in two other districts, south-central and east-central, also had an increase in turnover. Average plant size as well as turnover increased in three of these four districts which increased volume handled per plant. Because turnover was assumed uniform for a given geographic region and subsector, average plant size increased and plants were operating at a lower per unit cost than in previous years examined. The east-central district also gained in efficiency. Average plant size decreased relatively less than turnover increased, resulting in increased volume handled and decreased per unit handling costs. For the state in 1969 turnover increased and average plant size increased, resulting in lower per unit handling costs than in previous years analyzed. However, the industry was still far from realizing all economies of size associated with handling grain as will be analyzed in more detail in a later section.

As in the two years previously studied all nine districts and the state as a whole had fewer cooperative than non-cooperative plants though total cooperative numbers in 1969 were up 3.11 percent over 1960. Cooperative plants as a percentage of all elevators increased from 30.6 percent in 1960 to 36.6 percent in 1969.

Total non-cooperative capacity exceeded total cooperative capacity in seven of nine districts but total cooperative capacity was greater for the entire state. Cooperative capacity as a percentage of total capacity increased from 36.8 percent in 1950, to 49.0 percent in 1960 to 50.3 percent in 1969. Over the two decade period the precentage

increase in cooperative capacity was 515.8 percent and in bushels was 26.400 to 162.570 million bushels.

As in 1960 only one district had a non-cooperative average plant size greater than the cooperative average plant size. Unlike 1960 it was the northeast rather than southeast district. Thus volume of grain handled by cooperative plants was greater than non-cooperative plants in the state as a whole and eight of nine districts assuming a uniform turnover for both subsectors. The cooperative average plant size for the state was 289,319 bushels; an increase of 10.3 percent. Volume handled was increased 10.8 percent, to 450,499 bushels. Comparable figures for the non-cooperative subsector were: average plant size, 165,100 bushels; up 37.0 percent and volume handled, 257,077 bushels; up 38.7 percent. Relatively speaking it may be said the non-cooperative subsector gained in efficiency compared to the cooperative subsector because of a greater precentage increase in average plant size and volume handled. In an absolute sense, assuming turnover uniform for both subsectors, the cooperative subsector was operating at a lower per unit cost because an average size cooperative plant handled a larger volume of grain.

An Evaluation in Relation to the Optimum Number and Size

In a previous section the statement was made that the Kansas country grain elevator industry was not realizing all economies of size associated with handling grain. A comparison will be made in this section between the situation as it was in 1969 and results using Fuller's study for the same year.

Cost-volume studies reviewed earlier indicated that economies of size were present in the country grain elevator industry. The same studies found that cost per unit decreased as volume increased for a given plant size.

Volume handled per plant may be increased by enlarging the grain supply area or increasing density of production in the present supply area. Density of production varies only slightly from one normal production period to the next and can not be controlled by grain elevators. Therefore to increase volume handled grain elevators must expand their grain procurement region. Increasing the grain supply area causes an increase in assembly costs.

Farm produced grain was found to be delivered to country elevators via farmer-owned trucks. Thus costs of assembly were borne primarily by the producer. Plant costs decrease as volume increases but assembly costs increase as distance hauled increases. A point is eventually reached where the increase in assembly costs are greater than the decrease in plant costs. Each cooperative member-owner shares savings of the cooperative so would like management to minimize plant costs. Simultaneously he must attempt to minimize his production costs. Fuller's optimum plant size is one which minimizes the sum of average plant costs and average assembly costs. Three LAC functions were derived using three levels of turnover; one, two and three. Least-cost volume, derived using a turnover of two, was applied to off-farm grain sales for 1969 to determine plant numbers and size.[14]

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[14]Fuller used a turnover of two and derived the optimum number and size of plants. His figure, 262, and that shown in Table 6, 338, vary for the following reason. In order to determine least cost volume,

Table 6 shows the relationship between actual number and size in 1969 and a desirable number and size for the same year.

Table 6. Actual number and average plant size versus desirable number and average plant size of country grain elevators by crop reporting district, Kansas, 1969.

Crop Reporting Districts	Actual		Desirable[a]	
	Number	Average Plant Size (bushels)	Number	Average Plant Size (bushels)
Northwest	125	199,256	28	698,231
West-Central	108	328,861	34	644,528
Southwest	171	386,743	64	685,430
North-Central	199	178,658	41	782,551
Central	248	203,770	35	799,366
South-Central	285	226,049	50	855,372
Northeast	119	186,487	30	773,333
East-Central	125	102,464	30	688,065
Southeast	155	71,948	26	702,181
State Total	1535	210,657	338	744,543

[a]See Footnote number 14.

Actual number of elevators per crop reporting district ranged from 108 in the west-central district to 285 in the south-central district in 1969. A more desirable number of plants ranged from 26 in the southeast district to 64 in the southwest district. Thus

density of production had to be calculated. Number of square miles per county and crop reporting district were divided into off-farm grain sales for the same geographic area and the result was labelled density of production. Production and off-farm grain sales were figured as five-year averages, 1965-69. Least-cost volume as derived by Fuller was divided into off-farm grain sales for 1969-70 to arrive at a desirable number of plants in 1969. Productivity in 1969-70 was the largest on record and percentage of off-farm grain sales was higher than in past years. Therefore, total off-farm grain sales were larger than Fuller's five-year average. Dividing least-cost volume, assumed constant, into the larger volume of off-farm grain sales caused plant numbers to increase, from 262 to 338.

in each district and in the entire state approximately three times more plants were present in 1969 than was determined to be desired with a turnover of two.

Actual average plant size per district ranged from 71,948 bushel capacity in the southeast district to 386,743 bushels in the southwest district. The comparable range for desired plant size was from 644,528 bushel capacity in the west-central district to 855,372 bushels in the south-central district. Average plant size in the nine crop reporting districts in 1969 ranged from approximately one-tenth to one-half of the desired size.

Desired plant size in all nine crop reporting districts was within the 600,000 to 999,000 bushel-class range as shown in the frequency distribution, Table 7. Only 104 or 6.8 percent of all country elevators in Kansas in 1969 were larger than 600,000 bushels. Some of these were greater than 600,000 bushels but smaller than the minimum plant size determined to be more economical, 644,528 bushels, for any single district. It can be said, then, that less than 6.8 percent of all elevators in Kansas in 1969 were large enough to minimize combined average plant costs and average assembly costs. Thus the industry was far from realizing all economies associated with handling grain.

Earlier it was stated that total production in 1969 was 612.9 million bushels and total volume of off-farm grain sales was 503.3 million bushels. A portion of off-farm grain sales was not marketed through country grain elevators. An attempt was made to obtain information on the percentage not passing through country grain

Table 7. Frequency distribution of country grain elevators according to storage capacity and with percentage of plants in each size class, by type of ownership, Kansas, 1950,1960, and 1969.

Classes (1,000 bushels)	Cooperative (Number)	Percent	Non-Cooperative (Number)	Percent	Total (Number)	Percent
1950						
0 - 99	310	79.1	1,155	92.4	1,465	89.2
100 - 199	62	15.8	53	4.3	155	7.0
200 - 299	8	2.0	23	1.8	31	1.9
300 - 599	9	2.3	16	1.3	25	1.5
600 - 999	3	0.8	3	0.2	6	0.4
1,000 -	0	0.0	0	0.0	0	0.0
Total	392	100.0	1,250	100.0	1,642	100.0
1960						
0 - 99	128	23.5	842	68.1	970	54.5
100 - 199	145	26.6	193	15.6	338	19.0
200 - 299	87	16.0	78	6.3	165	9.3
300 - 599	144	26.4	77	6.2	221	12.4
600 - 999	29	5.3	30	2.4	59	3.3
1,000 -	12	2.2	.7	1.4	29	1.6
Total	545	100.0	1,237	100.0	1,782	100.0
1969						
0 - 99	116	20.7	558	57.3	674	43.9
100 - 199	140	24.9	176	18.1	316	20.6
200 - 299	101	18.0	96	9.9	197	12.8
300 - 599	148	26.3	96	9.9	244	15.9
600 - 999	40	7.1	27	2.8	67	4.4
1,000 -	17	3.0	20	2.0	37	2.4
Total	562	100.0	973	100.0	1,535	100.0

elevators; however, sufficient information was not available. Pretzer's sample survey obtained data on grain received and sold by country elevators.[15] His data could not be used to derive a percentage of marketed grain by-passing country elevators. The only conclusion which could be drawn was that volume of grain by-passing country elevators has not changed significantly during the past 15 years. Therefore, total off-farm grain sales were assumed to pass through country elevators.

[15]Pretzer, Organization of Country Elevators, pp. 42-46.

The assumption was an oversimplification but one which did not alter the conclusions. According to Pretzer's study in 1969 the cooperative subsector received 50 percent of total grain receipts by country elevators. Applying the 1969 percentage to 1969 off-farm sales showed the cooperative subsector handled 251.650 million bushels of grain.

Using a turnover of two each more desirable size cooperative plant, 744,543 bushels, would have handled 1.489 million bushels. In 1969 actual average plant size was 289,286 bushels and volume handled was 451,286 bushels. Again, the actual situation in 1969 was found to be far from the situation determined to be more economical.

Further examination of Table 7 reveals changes in elevator size since 1950. Though average elevator size was less than desirable, the industry has been moving toward fewer but larger plants. Increased plant size combined with a larger volume of marketed grain results in lower per unit handling costs according to past studies. Therefore the industry has been reducing handling costs per unit but has not yet minimized per unit costs.

CHAPTER VI

COOPERATIVE ELEVATOR NUMBERS AND SIZE IN 1980

Analysis revealed the Kansas country grain elevator industry has been moving in the direction of fewer but larger plants. Also it was determined the industry in 1969 still was far from obtaining all economies of size associated with handling grain. One objective of this study was to estimate an economical number and size of cooperatively owned country grain elevators in Kansas for 1980. Before estimating an economical number and size of grain elevators the probable grain production and marketing situation must be examined.

Production and Grain Marketing Estimates[16]

Barring the introduction and rapid acceptance of meat substitute products the demand for meat and meat products is expected to continue rising as population and per capita consumption increase. Kansas producers are expected to benefit from the increased demand and will produce a larger percentage of the total production of beef and pork in the U.S. by 1980. The expansion in the Kansas livestock industry will cause an increased demand for feed grains just as the increase in population will cause an increased demand for food grains. The demand for food and feed grains will be met by an increase in grain production, primarily due to larger yields per acre. Thus the quantity of food and feed grains produced in Kansas is expected to

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[16]For a more complete discussion on production and policy alternatives used, see; Buller, Kansas Agriculture and Abribusiness in 1980, pp. 20-23.

increase substantially during the 1970's.

Total agricultural production is directly influenced by agricultural policy. Three farm policy alternatives were used; (1) voluntary land retirement, (2) a free market situation, and (3) acreage allotments. Voluntary land retirement allows a producer to remove land from the production of specific crops for a direct per acre payment on land removed. Because of high costs to the taxpayer for such a program other alternatives were considered. One was a free market situation in which resources would be allocated on the basis of supply and demand. The free market approach also presents serious problems in terms of social costs. A third possibility would be an acreage allotment program with allotments dependent upon a per farm land base and historical usage data of total farm acres.

Production estimates used in this study were those determined in a previously sited publication. Estimates were based on a Heady-Mayer study and were modified for Kansas in some cases.[17] Production estimates for 1980 do not include rye grain as had previous production data. Rye production has been decreasing in Kansas in recent years and in 1969 comprised only 1.8 percent of total grain production. Therefore rye grain was excluded from the 1980 discussion. Production estimates for 1980 under the three policy alternatives discussed were; (1) 690.2, (2) 709.2, and (3) 651.8 million bushels respectively.

Percentage of off-farm grain sales increased 11.5 percent during

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[17] E. O. Heady and Leo V. Mayer, Food Needs and U.S. Agriculture in 1980, National Advisory Commission on Foods and Fiber, Technical Papers, Vol. 1, 1967.

the 1960's and 8.2 percent from 1960-69. Though percentage of grain sold off Kansas farms has increased during the past two decades the trend may or may not continue.

Two problems are evident. First, how will percentage of off-farm grain sales change by 1980? As was noted earlier not all off-farm grain sales were marketed through country grain elevators. Second, how much marketed grain by-passes country elevators and what changes can be expected by 1980?

The structure of farming has been changing.[18] Farm size has increased because total farm numbers have decreased. Cash grain farming has been declining in absolute and relative importance since 1959 and is expected to continue declining during the 1970's. Diversification on farms which were previously cash grain operations is expected to be limited to one livestock enterprise and one feed grain. Thus, livestock farming operations have become and will continue to be relatively more important despite a reduction in livestock farm numbers. The shift towards large grain producing operations combined with livestock operations may reduce total volume of grain marketed. More grain may be fed where it is produced than has occurred in the past thus causing percentage of off-farm grain sales to decline or remain at nearly the present level.

Though the above indicates a movement in the opposite direction the trend has been toward a higher percentage of off-farm grain sales. Therefore, estimated percentage of off-farm grain sales is somewhat

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[18]Buller, Kansas Agriculture and Agribusiness in 1980, pp. 56-62.

arbitrary. Three alternatives were chosen based on the 1969 percentage, rounded to the nearest whole number. Alternatives chosen were: an increase of five percent (87%), a decrease of five percent (77%), and no change from 1969 (82%).

The second problem mentioned may be more difficult. A portion of total marketed grain is not handled by country elevators. Some grain included in off-farm grain sales is sold directly to terminal elevators, grain processors, specialized livestock operations or other farmers. As indicated earlier the percentage of off-farm grain sales which was not marketed through country elevators is unknown. Sufficient information is not available to determine the unknown percentage so the following discussion refers to the way in which it may change by 1980.

Some feedlot operators purchase grain directly from producers. Considering the trend toward more and larger feedyards, yard managers may engage in more direct contracting with producers for a desired quality and quantity of grain at a predetermined time and place. Thus the percentage of marketed grain handled by country elevators may decrease during the 1970's.

Because feedlots may not have facilities comparable to country elevators and can not provide similar services the percentage of marketed grain being handled by elevators may increase.

A third possibility would be that the percentage of marketed grain by-passing country elevators could remain at the present level because the resultant of several factors involved may not change from 1969. In addition, Pretzer's data could be interpreted to mean that whatever the percentage is, it has not changed appreciably

in the past 15 years and, therefore, may not change significantly during the 1970's.

Rather than choose an arbitrary percentage of marketed grain handled by country elevators, a simplification was made. For estimation purposes the total volume of off-farm grain sales was assumed to pass through country elevators. The conclusions reached in this study are not significantly affected using the above assumption.

Pretzer found cooperative grain elevators handled 40 percent of the total volume of grain received from all sources by country elevators in 1954. By 1968 the cooperative subsector handled 50 percent of the total volume received by all country elevators. The percentage of total marketed grain handled by cooperatives may continue to increase during the 1970's, but no available data showed that the trend would continue as it has over the past 15 years so the 1968 percentage, 50 percent, was used for 1980 estimates.

Applying alternative off-farm grain sale percentages to grain production estimates produced alternative estimated volumes of off-farm grain sales for 1980. (Table 8). Cooperative elevators would handle 50 percent of total off-farm grain sales, using the 1968 percentage. Resulting volume levels for the cooperative subsector are shown in Table 9.

Table 8. Estimated total volume of off-farm grain sales using alternative estimated off-farm grain sales percentages and alternative estimates of total grain production, Kansas, 1980.

Agricultural Policies	Estimated Off-Farm Grain Sales		
	77%	82%	87%
	(1,000,000 bushels)		
Voluntary Land Retirement	531.454	565.964	600.474
Free Market	546.084	581.544	617.004
Acreage Quotas	501.886	534.376	567.066

Table 9. Estimated total volume of grain handled by cooperatives using alternative estimated off-farm grain sales percentages and alternative estimates of total grain production, Kansas, 1980.

Agricultural Policies	Estimated Off-Farm Grain Sales		
	77%	82%	87%
	(1,000,000 bushels)		
Voluntary Land Retirement	265.727	282.982	300.237
Free Market	273.042	290.772	308.502
Acreage Quotas	250.943	267.238	283.533

Range of Cooperative Plants Needed

Grain production, volume and percentage of off-farm grain sales, and volume and percentage of grain handled by cooperative elevators have been estimated. How many cooperative grain elevators will be needed to handle the expected volume of grain in 1970? A range of plant numbers will be determined in this section.

Percentage of cooperative grain receipts to total grain receipts was kept at the 1968 level, 50 percent. Applying this percentage to the high and low estimates of total off-farm grain sales in 1980 determined the high and low estimates of grain handled by cooperatives. Expected volume of grain handled by the cooperative subsector may increase by 22.6 percent or it may decline slightly, by 0.3 percent, from the 1969 level. The low estimate of 1980 in terms of volume was larger than any previous year except 1969 when production was a record high level. Thus the cooperative subsector is expected to handle more grain in 1980 than it handled in 1969.

Optimum plant size expected in 1980 was not determined. Least-cost volume increases as plants handle more grain per year but how much least-cost volume would change by 1980 could not be determined. Therefore, least-cost volume for each LAC function derived by Fuller was assumed constant. Plant size was determined for a given turnover level after figuring least-cost volume. Alternative totals of off-farm grain sales were divided by least-cost volume to determine elevator numbers. Table 10 shows the range of cooperative plants determined to be needed in 1980.

Table 10. Range for the desirable number of cooperative grain elevators needed to handle the expected volume of marketed grain in 1980 using three turnover figures.

Turnover	Range of Plants	
	Low	High
1	169	208
2	168	207
3	156	192

Least-cost volume probably will increase by 1980. If least-cost volume increases fewer cooperative grain elevators will be needed than is shown in Table 10. Thus, optimum number of cooperative plants is below or within the range of plants given considering only the grain handling and assembling function. Though an optimum number could not be derived the cooperative subsector would handle grain at a lower cost per unit if by 1980 plant numbers were reduced to between 156 and 208 plants. As stated earlier, in 1969 cooperative plants numbered 562. In order for cooperative plant numbers to be within the range given above, a 63 to 72 percent reduction must occur by 1980. At the same time cooperative average plant size must increase from 85 to 413 percent of average size cooperative elevators in 1969. Unless the grain elevator industry undergoes a major and unforeseen reorganization changes of that magnitude are not likely to occur.

Estimate of Actual Number and Size

Because only three time periods have been used it is difficult to make projections based on the data available. As was mentioned earlier there appears to be some uncertainty concerning the direction and degree of change in several factors. Numerous combinations of estimated production, off-farm grain sales, relative importance of cooperatives and other factors are possible. Therefore, an estimate of the actual number of cooperative plants in operation by 1980 will not be attempted.

During the past twenty years cooperative plant numbers increased as did total capacity and average elevator size. Trends of the past two

decades may be expected to continue through the 1970's. With respect to cooperative plant numbers; however, a continuation of the trend toward more cooperative elevators may be unexpected. Percentage increase in number of cooperative elevators from 1950 to 1960 was 29.5 percent while the increase from 1960 to 1969 was only 2.7 percent. Examining these percentage changes and noting the declining non-cooperative plant numbers, cooperative elevator numbers may soon reach their peak and begin to decline during the 1970's. Thus a more reasonable expectation might be that cooperative plant numbers will decrease while plant size continues to increase during the 1970's.

CHAPTER VII

IMPLICATIONS

Of what importance is an analysis of past and expected future changes in the country grain elevator industry? This section will attempt to answer this question for those persons in planning or decision-making positions with grain handling firms, for cooperative elevator member-owners and for producers and consumers in general. First, a partial summary of some of the information previously presented is given in Tables 11, 12 and 13.

Table 11. Production, off-farm grain sales and turnover, Kansas, 1950 to 1969, with estimates for 1980.

	1950	1960	1969	1980[a]
Total Grain Production (1,000,000 bushels)	344.9	596.4	612.6	690.2[b]
Total Off-Farm Grain Sales (1,000,000 bushels)	234.8	452.6	503.3	566.0[c]
Turnover	3.3	1.5	1.6	2.0

[a]1980 figures are estimates.
[b]Median production estimate was used.
[c]Median off-farm grain sales percentage was used.

Table 12. Grain elevator statistics for all elevators, Kansas, 1950 to 1969, with estimates for 1980.

	1950	1960	1969	1980[a]
Total Number of Grain Elevators	1,642	1,782	1,535	380
Total Elevator Capacity (1,000,000 bushels)	71.653	292.086	323.331	282.926
Average Plant Size (bushels)	43,638	163,909	210,567	744,543
Volume Handled Per Plant (bushels)	142,993	254,026	327,874	1,489,000

[a]1980 figures are estimates.

Table 13. Grain elevator statistics for cooperative elevators, Kansas, 1950 to 1969, with estimates for 1980.

	1950	1960	1969	1980[a]
Volume of Total Off-farm Grain Sales Handled by Cooperatives[b] (1,000,000 bushels)	93.9	181.0	251.7	283.0
Number of Cooperative Grain Elevators	392	545	562	190
Cooperative Elevator Capacity (1,000,000 bushels)	26.400	142.973	162.579	141.463
Average Cooperative Plant Size (1,000,000 bushels)	67.347	262.336	289.319	744.543
Volume Handled Per Cooperative Plant (1,000,000 bushels)	220.682	406.568	450.499	1,489.000

[a]1980 figures are estimates.

[b]Percentages used were: 1950 and 1960, 40 percent; 1969 and 1980, 50 percent.

Grain production, total off-farm grain sales and volume of grain handled by cooperative elevators all are expected to increase. Elevator numbers are expected to continue declining but to reach a more economical position the number must decline relatively and absolutely more than in the past decade. To handle grain more efficiently cooperative elevator numbers also must decline. Total elevator capacity as well as cooperative elevator capacity has surpassed a desirable level. From the standpoint of grain handling efficiency capacity levels need to be reduced and reapportioned to be most efficient. Reducing and reapportioning total and cooperative capacity would permit an increase in average plant size. If total off-farm grain sales increase while total capacity decreases, turnover will increase, also. The level of

turnover assumed for 1980, two, is a reasonable number of times an elevator may turn its rated capacity and could be expected in 1980. With an increase in average plant size and turnover, volume handled per plant will increase. Whether average plant size, turnover and volume handled per plant changes sufficiently to reach the economic optimum depends partially on elevator planners and decision-makers.

Cooperative grain elevator management needs to examine its own situation with respect to grain handling efficiency. Each firm needs to consider elevator numbers, size, turnover and volume handled per plant. After examining its own situation an analysis needs to be made with respect to surrounding elevators.

When possible, smaller, older, less efficient plants should be closed and volume of grain available to them should be redirected through more efficient facilities. Many times reduction in cost per unit brings to mind business consolidations. With respect to grain handling costs, acquisitions and mergers allowing less efficient plants to remain in operation reduce costs very little or not at all. Rather than allowing the less efficient facility to remain in operation, its volume handled should be redirected to more efficient plants.

Mergers, however, could be a step toward more rapidly closing less efficient plants. A merger could take place with the distribution of stock based on the relative income prospects of each plant without the merger. Then the merged firm might more easily close the less efficient plant.

Phasing out smaller, less efficient facilities causes several things to occur. It reduces total plant numbers which has been determined to be desirable. Total capacity, also, would be reduced

which, from strictly a grain handling standpoint, is preferable. By eliminating smaller facilities average plant size increases, turnover increases and volume handled per plant increases. When combined these changes reduce handling costs per unit.

Reducing plant numbers and increasing volume handled in the remaining plants decreases average plant costs per unit. Another effect is to increase the assembly region for a given plant which increases assembly costs to producers. Economies achieved by decreasing plant costs are greater than diseconomies resulting from increased assembly costs for all plant sizes used by Fuller, up to one million bushels, assuming density of production constant at 5000 bushels per square mile. At that given density level plant-cost economies outweighed assembly-cost diseconomies until a plant handled more than three million bushels.

An overall recommendation might be to cease grain handling operations of less efficient facilities and to increase grain volume through more efficient plants. Such a step should not be taken blindly; however, because other factors must be considered. Welfare aspects associated with these changes are not dealt with in this paper but need further study and consideration. Some of the factors referred to will be discussed briefly.

Costs are associated with closing physical facilities. Country grain elevators have few, if any, alternative uses. Plants which have few productive years left may cause no serious problems but it becomes more important when less efficient plants have many productive years remaining. A related problem involves employers and employees. Job training, retraining and mobility problems arise as well as group

insurance plans, retirement funds and other such problems.

Pride arising from employment, ownership or relationship to the community must be considered and may cause problems. Because employees and member-patrons identify with a firm there may be reluctance to close less efficient facilities. In many rural communities the cooperative elevator, based on any of several criteria, is the largest firm. Retail merchants benefit by having an elevator located in their immediate area and often are reluctant to have it closed even though the elevator's efficiency is less than economically desirable. Thus, as with many issues of interest to the community, politics or the community power structure becomes a factor to consider.

To overcome these and possible other problems it becomes imperative for cooperative elevator managers to be aware of costs associated with handling and assembling grain. Member-patrons may hesitate to agree with management or the board of directors unless gains resulting from changing elevator operations can be seen clearly.

Handling and assembly costs are important to cooperative member-patrons as was mentioned earlier. Non-cooperative firms and patrons are also interested in handling and assembly costs. If the cooperative subsector reduces combined plant and assembly costs, non-cooperative firms may also attempt to reduce their costs in order to compete successfully. Reduced handling costs to elevator firms may mean higher prices could be paid for grain sold by producers. To consumers reduced grain handling costs may mean lower prices could be charged on products produced from grain. Thus, competition benefits both producers and consumers.

This paper suggests that the trend is and, from a least-cost standpoint of handling and assembling grain, should be in the direction of fewer and larger grain elevators.

As was previously mentioned, in 1969 total elevators numbered 1,535 and cooperative elevators numbered 562. On the average for the 105 counties in Kansas, each county had 14.6 elevators, of which 5.4 were cooperatively owned. (See Table 14) In 1980 as few as 312 to 416 total plants could handle the estimated volume of marketed grain. As few as 156 to 208 cooperative plants could handle the portion of total grain marketed which is expected to be handled by cooperatives. Plant numbers would range from three to four per county and cooperative plant numbers would range from one and one-half to two plants per county.

Table 14. Total and cooperative plants per county, Kansas, 1969, with high and low estimates for 1980.

	1969	1980[a]	
		Low	High
Total Number of Elevators	1535	312	416
Number of Elevators Per County	14.6	3.0	4.0
Total Number of Cooperative Elevators	562	156	208
Number of Cooperative Elevators Per County	5.4	1.5	2.0

[a]1980 figures are estimates.

Moving from a situation where cooperative elevators averaged 5.4 plants per county to a situation where there may be one and possibly no cooperative plants per county could have a major impact on competition. Exactly what impact this would have cannot be determined but deserves further study.

Fewer but larger total and cooperative elevators are recommended from this economic analysis which emphasized grain handling efficiency. A point which must be stressed is that impact on the grain elevator industry brought about by changing other social and economic factors was not examined in this study.

CHAPTER VIII

SUMMARY AND CONCLUSIONS

From the standpoint of grain handling efficiency an economic analysis revealed that there are too many cooperative and non-cooperative grain elevators. Approximately 93 percent of all elevators in operation in 1969 were smaller than those deemed to be most efficient.

In order to lower grain handling costs to a level approaching an economic optimum cooperative plant numbers must be reduced by at least 63 percent of the present number. Rather than declining, cooperative plant numbers have increased since 1950. A favorable indicator is that cooperative plant numbers increased relatively and absolutely less during the 1960's compared to the 1950's, so may begin to decline during the 1970's.

In order to lower grain handling costs to a more desirable level average plant size must increase, also. Cooperative average plant size must increase by at least 85 percent and average plant size for all plants must increase by an even larger percentage. Average cooperative plant size has increased since 1950 but increased relatively and absolutely less during the 1960's compared with the 1950's.

Grain production in Kansas has increased since 1950 and is expected to increase by at least six percent by 1980. Even if there is a five percent decline in percentage of off-farm grain sales from the 1969 figure, volume of total grain marketed is expected to increase by 1980. From 1954 to 1968 the cooperative portion of total grain marketed increased from 40 to 50 percent. Assuming this percentage remains the

same in 1980, and it may increase, the cooperative subsector is expected to handle a larger volume of grain than anytime in the past.

Knowing the cooperative subsector is expected to handle more grain in 1980 than in the past might cause some to think that more and larger cooperative elevators are needed. Partially, that thought is correct. Cooperative plants need to become larger on the average; however, the way in which this occurs is important.

Rather than blindly building new plants or increasing storage capacity of present elevators several factors must be considered. Economies of size do exist; however, from a cost standpoint it would be preferable to increase volume of grain handled through the present facilities. It has been found to be more desirable to close smaller, less efficient branch facilities and redirect the available grain through more efficient facilities. Closing branch facilities will increase assembly costs to some producers but plant cost economies outweigh assembly cost diseconomies for nearly all elevators in Kansas. Thus, the most economical way to increase average cooperative plant size is to eliminate smaller, less efficient plants.

Reducing cooperative plant numbers also reduces total capacity in the state if no new facilities are built. This, in turn, causes turnover to increase and increases average cooperative plant size which together increases volume handled per plant. The combined effect of these changes would be a reduction in grain handling costs per unit.

This analysis was based on handling and assembling Kansas produced grain. When considering the storage function, related services, other lines of products handled and all socio-economic factors the end result

may change somewhat. The optimum number of cooperative elevators, all factors considered, may be greater than the upper figure estimated in an earlier section, 208. However, it is likely that the economic optimum is considerably below the number present in 1969 and a movement in the direction of fewer and larger elevators would be beneficial in that it would reduce grain handling costs per unit for producers.

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AN ECONOMIC ANALYSIS OF THE NUMBER AND SIZE OF COOPERATIVE GRAIN ELEVATORS IN KANSAS, 1950 to 1980

by

CLEMENT E. WARD

B. S. Iowa State University of Science and Technology, 1966

AN ABSTRACT OF A MASTER'S THESIS

submitted in partial fulfillment of the

requirements for the degree

MASTER OF SCIENCE

Department of Economics

KANSAS STATE UNIVERSITY
Manhattan, Kansas

1971

Research has found that economies of size are present in the Kansas country grain elevator industry. An economic analysis was conducted to determine whether cooperative country grain elevators were achieving grain handling and assembling economies and, if not, whether they were moving in the desired direction. Cooperative elevator management needs to be informed of possible economies to assist in planning more efficient future grain handling operations.

The years 1950, 1960 and 1969 were selected to be examined. Data were collected on number and size of Kansas country grain elevators. To evaluate efficiency, in terms of least-cost volume handled, grain production and off-farm grain sales data were collected. Then, comparison of the actual data was made with cost-volume studies to determine past grain handling efficiency. A recent Kansas study was used to determine a near-optimum number and size of cooperative country grain elevators in 1969.

Analyzing data for all three years showed that cooperative grain elevators were not achieving all economies associated with handling grain. Cooperative elevator numbers have increased though fewer elevators would be more economical. Average plant size has increased as has volume handled per plant since 1950. This trend has enabled handling costs to be reduced but a further reduction is possible.

Grain production, off-farm grain sales and the portion of marketed grain handled by cooperatives in 1980 were estimated. Alternative estimated plant numbers and sizes were derived for varying turnover levels. Elevator numbers and size estimates for 1980 were not the estimated economic optimum, but would greatly improve grain handling and assembling efficiency in the cooperative subsector.

To achieve all economies of handling and assembling grain in the Kansas

cooperative country grain elevator industry by 1980 major changes must occur. Plant numbers must decrease at least 63 percent and cooperative average plant size must increase at least 85 percent from comparable data in 1969. After viewing changing plant numbers and sizes over the past twenty years it is unlikely these changes will occur.

This study dealt only with the grain handling and assembling function of grain elevators. Considering only this function the desirable number of cooperative elevators in 1980 would be between 156 and 208 plants. The economic optimum, all factors included, would likely be more than the upper figure; however, a movement towards that number would improve grain handling and assembling efficiency and benefit both producers and consumers.