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GRAIN MARKETING

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U.S. DEPARTMENT OF AGRICULTURE

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## GRAIN MARKETING

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### INTRODUCTION

The flow of grain through the marketing channels from the producer to the consumer has been continually changing over time. Increased grain supplies and changing demand for grain and grain products have been largely responsible for altering the marketing system. Many of the influencing factors have affected certain segments of food and feed grain marketing in different ways.

The changes which grain marketing has undergone in recent years have resulted from several factors: larger farm production units, technological advances in harvesting grains, changes in marketing channels to increase efficiency, improved transportation methods, Government programs, and changing demands of grain consumers. Some of these changes took the form of mergers, consolidations, integrations and liquidations, or creation of new agencies.

Technological advances in farming and farming methods brought about increases of 80 percent in farm output per man-hour between 1954 and 1964 and about 33 percent in total farm production, and a decrease of about 25 percent in the number of farms. These changes have brought about complementary changes in the marketing system.

### Country Elevators

The primary function of country grain elevators is to receive grain from the farms by truck for future delivery to a secondary elevator or processor. Country elevators serve as the major outlet for grain sold from farms and are extremely important in the grain-producing regions of the United States. They perform such services as grading, storing, and blending of grain, and in addition may merchandize coal, fertilizer, feed supplies, hardware, and other farm supplies.

Some country elevators are busy throughout the year while others operate only during the season of heavy crop marketing. Services offered vary greatly and may be affected by the length of the harvesting season.

A country elevator may be equipped with machinery for conditioning grain by drying, cleaning, clipping, etc. The storage capacity of country elevators ranges from a few thousand to over a million bushels. Grains are sometimes transferred from one part of elevator storage to another to fumigate and maintain the condition of the grain.

In recent years, increasing numbers of country elevators have installed grain driers to handle high-moisture grain. New harvesting machinery, such as self-propelled combines, corn picker-shellers, and other equipment, has increased the harvesting rate. As a result, some drying is necessary to keep the grain from spoiling. Shortening the harvest season has also increased the demand for storage capacity.

Buying, handling, and selling practices of grain elevators and forwarding of grain to the central markets are fairly uniform among all types of country elevators.



A typical modern country grain elevator.

However, the method of purchase varies with the different grains, season of the year, section of the country, and policy of the individual elevator. Elevators may obtain grain from farmers by purchasing outright at time of delivery, by contracting in advance of delivery, by accepting grain for storage with sale to be made at a later date, and by handling grain for the farmer's account without ever taking possession of it (5). 1/ The most commonly used method is outright purchase at time of delivery.

In some areas, a major service of country elevators is receiving the grain from farmers for storage and subsequent shipment; in this case, the farmer retains ownership of the grain until it is sold at destination.

With the great increase in off-farm sales of grain between 1939 and the early 1960's, the average country elevator increased its volume of business over four times. Country elevators continued to be the major outlet for off-farm sales of feed grains, but because of improved roads and larger trucks, which encourage the movement of grain to more distant markets, increasingly larger volumes of grain began bypassing nearby elevators. With this trend, a number of country elevators increased their capacities and functions, and entered the category of subterminal elevators. From 1939 to 1963, the number of country elevators in the United States decreased from 9,000 to 7,650 (table 1). The number of elevators declined to about 7,000 in 1958 but increased in the following 5-year period.

The growth in subterminal elevators combining functions of country and terminal elevators has been the most noticeable change at the assembly level of the marketing channel. Grain passing through a subterminal elevator is handled one less time than if it is marketed through a country elevator and then passed on to the terminal.

#### Subterminal Elevators

In general, subterminal elevators are located away from metropolitan areas and are the only large grain-handling facilities in the immediate vicinity. They tend to be large, but their capacity is an incidental characteristic. Some subterminals are smaller than the largest country elevators, while others are larger than some terminal houses.

Subterminal elevators rely on country elevators in their area to provide them with grain by either rail or truck. The subterminal generally has transit privileges for grain. The manager sells directly to terminal elevators, processors, and exporters instead of selling to interior dealers or commission merchants. Many subterminal elevators have facilities that were formerly available in terminal elevators only.

The growth of subterminals was stimulated in recent years by intense competition within the industry and by the importance of achieving lower operating costs. Storage of Commodity Credit Corporation grain stimulated construction of large new elevators, which in turn undertook more active merchandising programs.

#### Terminal Elevators

Terminal elevator operators buy grain from cash grain merchants, subterminal elevators, and country elevators. Depending on their facilities, they may receive

1/ Underscored numbers in parentheses refer to Selected References, p. 254.

Table 1.--U.S. country elevators: Number of establishments and value of sales by regions, 1939, 1948, 1958, 1963

Regions	Establishments				Value of sales			
	1939	1948	1958	1963	1939	1948	1958	1963
	No.	No.	No.	No.	1,000 dollars	1,000 dollars	1,000 dollars	1,000 dollars
Northeast.....	2	1/	7	2/	1/	1/	3,418	2/
Middle Atlantic.....	18	44	51	2/	1,896	18,174	17,307	2/
South Atlantic.....	22	35	107	2/	1,132	14,675	53,482	2/
North Central.....	7,402	6,790	5,394	2/	579,353	2,914,630	2,379,602	2/
South Central.....	696	706	574	2/	46,915	356,017	217,441	2/
Mountain.....	730	784	657	2/	43,955	322,521	267,913	2/
Pacific.....	214	190	210	2/	21,785	169,314	105,420	2/
United States.....	9,084	8,549	7,000	7,650	695,036	3,795,331	3,044,583	5,000,000

1/ Withheld to avoid disclosure of individual firms' operations.

2/ Data for 1963 are preliminary or not available.

Source: U.S. Census of Business (39).

grain delivered by rail, truck, barge, or boat. In turn, terminal elevator operators sell grain to processors, millers, distillers, feed manufacturers, exporters, and sometimes elevators in other parts of the country. They ship by rail or water; less commonly, they ship small quantities by truck.

Terminal elevators are located in the principal grain-marketing centers. Their capacity may vary from a few hundred thousand bushels to over 50 million bushels. Location rather than size determines whether an elevator is classified as terminal.

Like country elevators, terminal companies may be owned (1) independently, (2) by farmer cooperatives, or (3) by integrated terminal companies.

Integrated companies operate terminal elevators in more than one marketing center. Overall policy as well as financing may be provided by the home office. Day-to-day merchandising activities are usually carried on by the individual management at the terminal location (17).

The number of terminal elevators in the United States increased from 400 in 1948 to 690 in 1958 (table 2). These elevators received grain primarily from country elevators and other assemblers. The increase was due mainly to a reclassification of establishments formerly classified as country elevators. However, the 1963 Census of Business reported only 650 terminal elevators, which would indicate a reversal of the earlier trend.

Most of the increase in the number of terminal elevators took place in the North Central and South Central Regions. These regions include much of the wheat-producing Great Plains; the Corn Belt; and two areas of increasing exports, the Great Lakes and the Gulf Coast. Along with the increase in terminal elevators, a noticeable shift also occurred in the ranking of terminal markets according to storage capacity (table 3). About one-half of the 14 markets usually considered as primary terminal markets now have the largest storage capacity. 2/ This shift does not mean that these markets

2/ The following terminal markets are generally considered as the primary markets by the Chicago Board of Trade and the Consumer and Marketing Service, U.S. Department of Agriculture: Chicago, Duluth, Hutchinson, Indianapolis, Kansas City, Milwaukee, Minneapolis, Omaha, Peoria, Sioux City, St. Joseph, St. Louis, Toledo, and Wichita.

Table 2.--U.S. terminal elevators: Number of establishments and value of sales, 1948, 1954, 1958, 1963

Year	Establishments	Value of sales
	<u>Number</u>	<u>1,000 dollars</u>
1948 <u>1/</u> .....	391	2,828,323
1954. <u>1/</u> .....	460	1,793,728
1958.....	690	2,011,291
1963.....	650	<u>1/</u> 3,000,000
.....		

1/ Data for Alaska and Hawaii not included.

Source: U. S. Census of Business (39).

Table 3.--Ranking of U.S. grain markets according to greatest storage capacity, selected years 1/

Markets	1965	1963	1959	1949	1939	1929
.....						
Minneapolis.....	1	1	1	1	1	1
Kansas City.....	2	2	2	2	2	5
Wichita.....	3	3	3	12	12	8
Forth Worth.....	4	4	8	9	8	9
Chicago.....	5	5	4	4	4	2
Duluth-Superior.....	6	6	5	5	5	4
Enid.....	7	7	6	7	-	-
Lubbock.....	8	8	11	-	-	-
Salina.....	9	9	10	-	-	-
Buffalo.....	11	10	9	3	3	3
Hutchinson.....	10	11	12	11	-	-
Portland (Oreg.).....	12	12	7	-	-	-
Milwaukee.....	-	-	-	6	6	12
Omaha-Council Bluffs.....	-	-	-	8	7	6
St. Louis.....	-	-	-	10	9	-
Albany.....	-	-	-	-	10	-
Baltimore.....	-	-	-	-	11	7
St. Joseph.....	-	-	-	-	-	10
New York.....	-	-	-	-	-	11
.....						

1/ 12 largest grain markets had a combined total of 919,739,000 bushels of storage capacity in 1965.

Source: Heid, Walter G., Jr. U.S. Dept. Agr. Grain Marketing--A General Description. Paper presented at symposium on "Structure Conduct and Performance of the Grain Markets of the United States," Lincoln, Nebr., June 1, 1965.



A Great Lakes port grain terminal elevator showing grain handling by water and rail.

have lost volume, for their grain receipts have actually increased during recent years. It simply indicates that their volume of grain marketed has not increased as much as that of other terminals. Grain-marketing channels and markets have shifted, and as a result, these other terminal markets are more important in both receipts and storage capacity. Most of the grain is continuing to pass through either terminal or subterminal markets. During the 1963-64 marketing year, 82 percent of the wheat and 51 percent of the feed grains were channeled through subterminal or terminal markets.

#### Other Terminal Market Agencies

Terminal market agencies other than elevators are important in the collection and distribution of large volumes of grain. These agencies may or may not take title to the grain and do not have physical facilities for handling grain.

“Cash merchant” is a collective term describing any functionary operating between a seller and a buyer. The cash merchant does not take physical delivery of the commodity for which he acts as intermediary, since he has no facilities for warehousing. However, he may take legal title.

The cash merchant also functions between the producers of semifinished agricultural products (such as the soybean processors) and finished goods manufacturers (such as the feed manufacturers). The cash merchant “shops” these outlets for country elevator operators, although some country shippers may sell directly to buyers without using the services of a cash merchant.

The cash merchant may perform other services for the country shipper: He may find bidders, provide information about cash or futures markets, handle futures transactions, file shortage claims with railroads on behalf of the shipper, help obtain boxcars, assure that the grain is properly graded and weighed, and obtain financing.

The most important service performed by the cash merchant is to find bidders for grain. The country shipper chooses among bids after considering how far the grain must travel by rail or truck, how quickly the boxcar or truck is graded and unloaded, and how quickly the buyer will submit final accounting and payment. Because of these considerations, the country manager develops preferences for certain markets and users of grain, and may insist on premium bids to ship elsewhere.

Terminal receivers, merchandisers, and brokers are various types of cash merchants, differentiated somewhat loosely according to the services they emphasize.

Terminal receivers deal mainly in cash grain from country shippers, although they may solicit some business in futures. Usually the terminal receiver solicits his cash grain shipments from country shippers who, because of location, ship only to the terminal market where he is located. Most receivers take no market positions (they are not hedgers or basis traders) and their country purchases equal their terminal sales. They may buy and take title to grain at country points.

Merchandisers are the largest cash merchants and frequently engage in exporting, terminal elevator operations, etc. They are basis traders and consequently may have positions in both the cash and futures markets, although their net position will be even. Merchandisers provide the same services for country shippers as for terminal receivers. Although merchandisers may function in terminal markets, they usually operate “cross country” or in several interior markets. Like terminal receivers, merchandisers may buy and take legal title to grain at country points.

Brokers differ from other cash merchants mainly in not taking legal title to grain. They function strictly as agents, and are usually paid by the seller. Brokers are only of limited importance as intermediaries in the movement of grain.

Formerly, before the establishment of grain-purchasing departments by individual millers and processors, brokers bought grain on a fixed-fee basis. Because most of these firms now do their own buying, the services of brokers are not required as much as they were several decades ago.

Brokers are still important in exporting and in the movement of millfeeds, protein meals, and byproducts of various processing operations.

#### MAJOR GRAINS MARKETED

The most important food grains--those raised for human consumption--are wheat and rice. These grains require more care in marketing and more processing than the feed grains.

The most important feed grains--those primarily raised for livestock feeding--are corn, oats, barley, and grain sorghum. A portion of these grains is diverted to industrial uses, human food, and seed.

#### Wheat

During the 1963-64 marketing year, 1,378 million bushels of wheat cleared the market (fig. 1). Eighty percent of the total was sold off-farm--about 1,103 million bushels. The other 20 percent or 275 million bushels came from reductions in carry-over; of this, nine-tenths had been in commercial storage and one-tenth in CCC-owned bins.

Although reductions of carryover are shown as part of the total supply at the beginning of the flow diagram, these volumes had entered the marketing channels earlier through country, subterminal, or terminal markets, or CCC bin sites. The flow diagram shows that country elevators received only 66 percent of the total supply, but this understates their importance. They actually received 80 percent of the off-farm sales in 1963-64, and this would be their share of total supply in years when there was no net change in off-farm carryover. In other words, most of the supply which came from off-farm carryover and which bypassed the country elevators in 1963-64 actually had passed through country elevators in previous marketing years.

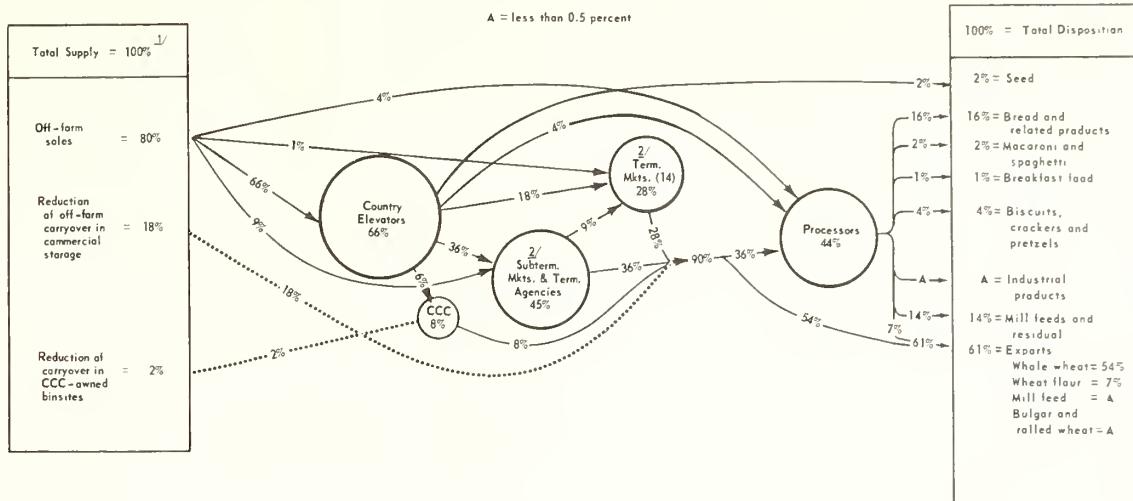
The percentage of processed wheat is becoming smaller in relation to the total supply entering the marketing channels. In 1939, 86 percent of all wheat was channeled to U.S. flour millers, but in 1963-64, only 41 percent of wheat was milled into flour.

Large increases in wheat exports have accounted for the relative decline in the percentage processed domestically. Exports reached a record high during the 1963-64 marketing year, when 60 percent of the wheat was exported. In comparison, 39 percent of the total volume was exported in 1959 and only 5 percent in 1939. Exports for the 1965-66 marketing year are expected to be at least 750 million bushels.

Processed products have accounted for a small but increasing portion of exports. In 1963-64, 7 percent of the total volume of wheat was exported in the form of processed products.

# MAJOR U. S. MARKETING CHANNELS FOR WHEAT, 1963-64

( All movement is from left to right )



1/ TOTAL SUPPLY DURING THE 1963-64 MARKETING YEAR WAS 1,378 MILLION BUSHELS. OFF-FARM SALES (97 PERCENT OF TOTAL PRODUCTION) TOTALEO 1,103 MILLION BUSHELS, OR 80 PERCENT OF THE TOTAL SUPPLY. REDUCTION OF OFF-FARM CARRYOVER IN COMMERCIAL STORAGE TOTALEO 249 MILLION BUSHELS, OR 18 PERCENT OF THE TOTAL SUPPLY, AND ENTERED THE MARKETING CHANNELS FROM THE TERMINAL AND SUBTERMINAL ELEVATORS. REDUCTION OF CARRYOVER IN CCC-OWNED BINSITES TOTALEO 26 MILLION BUSHELS, OR 2 PERCENT OF THE TOTAL SUPPLY, AND ENTERED THE MARKETING CHANNELS FROM CCC STORAGE SITES.

2/ TERMINAL RECEIPTS ARE BASED ON THE VOLUME OF INSPECTED RECEIPTS. FOURTEEN TERMINAL MARKETS INCLUDE CHICAGO, OULUTH, NUTCHINSON, INDIANAPOLIS, KANSAS CITY, MILWAUKEE, MINNEAPOLIS, OMAHA, PEOORIA, SIOUX CITY, ST. JOSEPH, ST. LOUIS, TOLEDO AND WICHITA.

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Figure 1

One of the primary changes in the flow of wheat since World War II has been the increase in carryover and the rapid expansion of storage facilities. The surpluses were a byproduct of the Government price-support programs which created not only greater storage capacity but also a new marketing agency, the Commodity Credit Corporation (CCC).

Although the CCC handles a relatively small quantity of surplus grain in its own facilities, it controls large quantities which are handled and stored by country, subterminal, and terminal elevators. In 1959, 41 percent of wheat stocks owned by the CCC was in non-CCC facilities. The carryover attributable to the support program increased the demand for storage space.

Some wheat marketing facilities would probably have grown in the absence of Government programs. Nevertheless, the programs have enhanced the growth of many facilities. This growth has tended to decrease the importance of the terminal markets. As more wheat shifts from terminal to subterminal markets, the terminal market price becomes less representative of the general trading price (23). If this trend continues, it would appear appropriate to reevaluate the usefulness of the present terminal price-quoting system.

In the past 4 years, demand for storage has diminished. This recent change has created a problem as to alternative uses for some wheat storage space. If wheat stocks continue to decrease, the problem will become acute for firms that have invested heavily in storage space.

Segments of the wheat marketing channel other than elevators have had a long history of excess capacity. Their experience has been one of below-average profits while the excess capacity in the industry is being worked off.

The length of time required for an industry to work out an overcapacity situation depends on several factors. One is capacity--facilities to handle excess stocks as required if individual elevators merchandise a large volume of grain. Another factor is the durability of the equipment and facilities.

The increased quantity of wheat moving through the marketing channels has increased the need for new transportation facilities. These new facilities have expanded to meet wheat transportation needs except during harvest periods. Transportation of wheat prior to 1939 was almost exclusively handled by rail; since then, water and highway carriers have carried an increasing proportion. However, rail is and probably will remain the dominant mode of transportation.

### Rice

One of the most striking characteristics of rough rice marketing in the United States is the small number of marketing firms. Rice moves directly from the farms to the driers (which are often located at the mills) or to the mills for processing. From the millers the rice moves through brokers to the wholesale or export market. Rough rice is marketed over a short harvest season, so storage facilities at driers and mills must be adequate to handle the total supply for the year.

The rough rice supply in 1963 was about 78 million hundredweight. Farm production accounted for about 90 percent of this total supply in 1963. Beginning stock made up most of the remaining 10 percent. Imports were less than 1 percent of the rice supply and had little effect on total supply.

Figure 2 presents in more detail the channeling of milled rice during 1963. Mill production during the year accounted for 97 percent of the milled rice going through marketing channels, and carryover stock accounted for the remainder.

Distribution of milled rice is aimed primarily at the export market. In 1963, 60 percent was exported; about 25 percent was consumed domestically as food; and breweries took about 5 percent. At the end of 1963, stocks at the mills and ports were 3 percent, about the same quantity as beginning carryover.

Rice marketing did not change as much after World War II as other grains did. Although exports became somewhat larger and technological advances took place, these did not have major effects on the market structure.

### Feed Grains

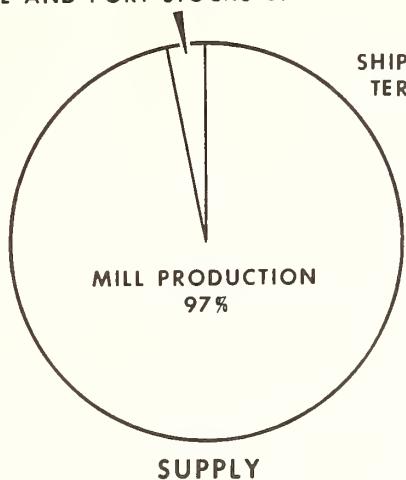
Channels for feed grains have experienced the same basic changes as wheat. The marketing of feed grains reflects both increased output and a shift from feed grains produced on the farm to increased use of commercial feeds. The percentage of feed grains sold off farms increased from about 25 percent in 1939 to 48 percent in 1963-64. In the same period, stocks in CCC-owned bin sites declined by 4 million tons (fig. 3). A total of 79 million tons of feed grains was marketed during 1963-64.

Country elevators continued to be the major outlet for off-farm sales of feed grains; in 1963-64 they handled 81 percent of the total volume. Terminal markets, usually considered the primary terminals, handled smaller percentages of the total, although the volume handled by these markets did not decrease.

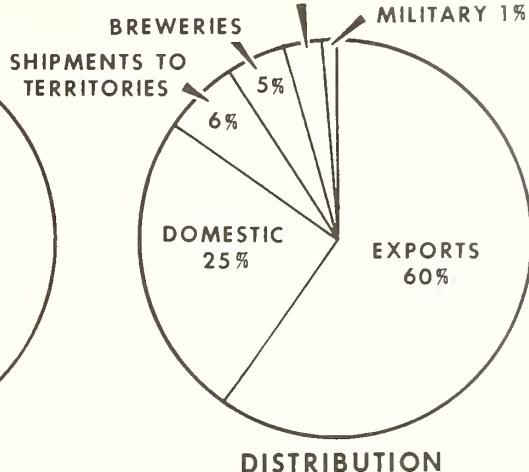
# MILLED RICE

## Supply and Distribution, 1963-64

IMPORTS, LESS THAN 1%  
MILL AND PORT STOCKS 3%



MILLED AND PORT STOCKS, 3%



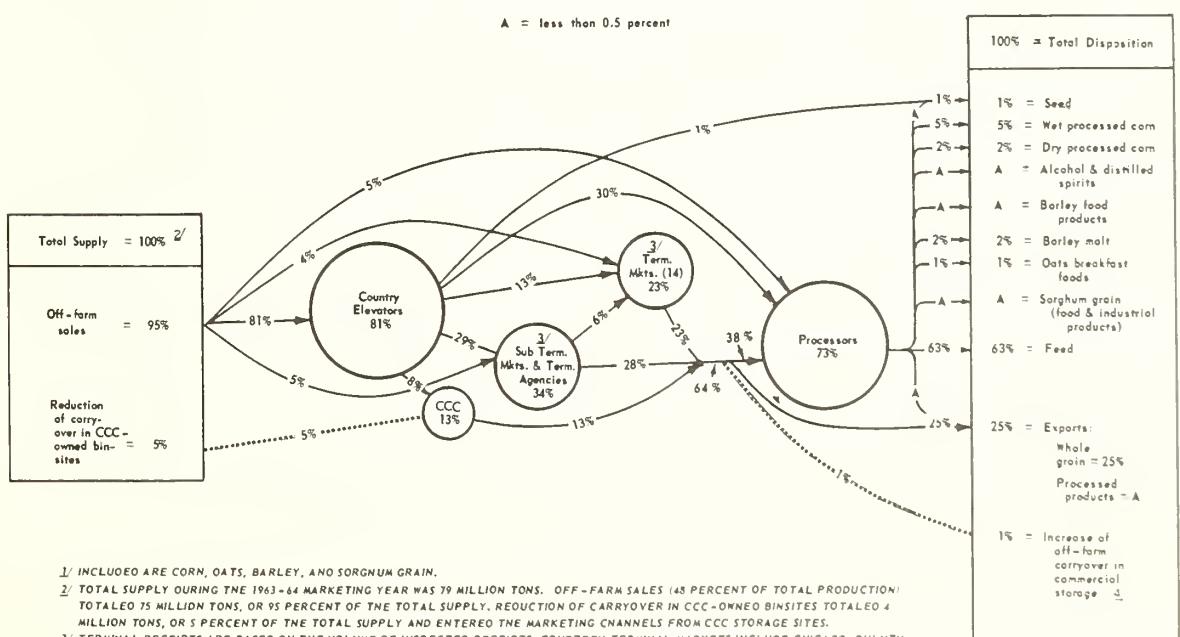
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Figure 2

## MAJOR U. S. MARKETING CHANNELS FOR FEED GRAINS, 1963-64 <sup>1/</sup>

(All movement is from left to right)



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Figure 3

In 1939-48, an average of 54 percent of the volume was marketed through the major terminal markets, and in 1963-64, about 23 percent. Smaller percentages of the total supply were handled by subterminal and terminal elevators, since nearly one-half of the total volume of prepared feeds was manufactured at decentralized country points. Nevertheless, subterminal and terminal elevators remained a major channel of distribution; they handled 51 percent, excluding interterminal transfer, of the total volume marketed in 1963-64.

Off-farm feed processing grew rapidly from 1939 to 1964. In 1939, only 29 percent of the total sold off-farm was manufactured into prepared feeds; in 1963-64 about 63 percent of the total supply went into prepared feeds. Exports of feed grains also reached a record high during the 1964-65 marketing year when 19 million tons, or 25 percent of the total volume marketed, were exported. Feed grain exports for 1965-66 are estimated to be about 23.3 million tons. In 1959, 18 percent was exported and in 1939, only 8 percent.

#### GRADING OF GRAIN

The Federal system of grain grading is an essential feature in the marketing of cash grain. This unified system of grain inspection, which is under the supervision of the Secretary of Agriculture, was established in 1916 when Congress passed the U.S. Grain Standards Act. Under the act, classes and subclasses, as well as grades within each class, were fixed for each type of grain. Grain is inspected and graded by licensed inspectors whose decisions may be appealed to Federal authorities. These inspectors are available at approximately 140 inspection points in the United States. They are thickly concentrated in the grain-producing areas, in primary markets, and in port facilities along the Pacific Coast, Gulf Coast, Lake ports, and the Atlantic seaboard.

In addition to inspection supervision, the U.S. Grain Standards Act provides for continuing research designed to improve crops and to eliminate preventable losses to growers and handlers of grain.

Accurate, definite, and reliable grade determination is essential to many phases of marketing. With accurate grading, the farmer obtains a more exact price than when price was based on the "average for the crop" in his locality. The producer of better than average quality receives benefits in higher returns. Market reports are likely to be vague and misleading unless they are based on precise grades. Accurate grading makes possible modern bulk grain warehousing and commingling of grain with assurance of fairness to the owners of any part of it. Futures contract trading would be impossible if grain were not graded for delivery on contracts. Transactions for the purchase of grain from distant grain markets would be much more hazardous without the use of grades.

Accurate grading is also of particular importance in the export market. The exporting countries capable of supplying a uniform product have gained buyer preference for their grain.

#### GRAIN EXCHANGES

The primary function of a grain exchange is to provide a meeting place where buyers and sellers may gather and effect their trades. Additional functions are to promulgate regulations to promote uniform practices among market operators; to provide judicial machinery for adjusting business disputes; and to disseminate valuable market information to members and their customers.

Historically, grain exchanges developed trading centers in localities where it became expedient for buyers and sellers to assemble for trading. Some of these centers have grown into organized grain exchanges of national importance, and others have functioned in a more modest way as local markets.

The Chicago Board of Trade was not the first organized grain exchange, but it rapidly became the leading grain market of the country. The preeminence of Chicago as a grain market was directly attributable to its strategic location at the southern end of Lake Michigan, a natural junction between the East and the West.

After the Chicago Board of Trade was organized, the practice of buying and selling grain on the basis of the measured bushel was discontinued and the system of buying and selling by weight was adopted.

In 1857 the Board inaugurated a system of grain inspection. This activity was originally under the direction of the Board of Trade, but it was later taken over by the State of Illinois.

Grain exchanges have developed their own rules, but they are regulated by State and Federal laws. Early efforts to regulate grain exchanges culminated in passage of the Futures Trading Act in 1921. The Act was attacked in the courts, however, and was declared unconstitutional.

The Commodity Exchange Act authorized limitations on both the amount of speculative trading in one business day and the amount of the speculative net position that may be held at any time by any one person or by a group of persons acting as a unit. Hedging transactions are not included in such limitations. Under the Act, receipts issued under the U.S. Warehouse Act (which regulates grain stored for interstate and foreign consumers) are acceptable in satisfaction of any futures contract, providing that such receipts are for the kind, quality, and quantity of commodity specified in such contracts. The commodity must be stored in warehouses meeting requirements imposed by the contract market as to location and accessibility.

The general activities of grain exchange members may be classified as dealing in actual or cash grain and trading in contracts for the delivery of grain at some future time. Cash grain activity centers around the trading of specific lots of grain. Futures contracts differ from cash grain transactions in that such trades do not call for delivery of specified lots. Contracts are fulfilled by delivery of grain of a certain class and grade without reference to a designated sample.

The Chicago Board of Trade originated the practice of trading in contracts for future delivery. The early rules of the Board do not disclose exactly when futures trading began and do not differentiate sharply between cash and futures. Futures Trading grew out of the contracts in cash grain, known as "to arrive" contracts. Trading in "to arrive" contracts began shortly after the inauguration of the Chicago Board of Trade. Futures trading came to the front in the Chicago market, which has become the leading grain futures market.

Orders for the purchase or sale of futures contracts on the commodity exchanges fall into two classifications: orders "at the market" for execution at the earliest possible moment at the prevailing price; and "limited orders" which, as the name implies, state a condition of price or time which the customer must decide upon (21).

A "limited order," if designated as "open," remains in force until filled or canceled. In the absence of such a designation, it is treated as a "day order" only, and cancels itself at the close of the market the day it is received. A "stop-loss"

order is one that sets upper or lower limits at which it is to be executed; it becomes a "market order" when the price reaches the limit specified. A stop-loss order also may be designated as open or as a day order. There are many kinds of limited orders, though most of them simply specify the price at which the customer is willing to buy or sell. In the event the market breaks through such a price limit and the broker is unable to make the trade at the limit price, he is relieved of any responsibility for loss.

Grain exchanges use a clearing house organization in settling and adjusting contracts. The clearing house removes the responsibility of one member to another for trades made between them.

A clearing house may be a department of an exchange, governed by the exchange board of directors under the direct supervision of a clearing house committee and a manager, or it may be a separate organization with its own financial organization and government. In the latter case, exchange rules provide that all pit transactions be cleared through the clearing house; here the rules must meet the approval of the clearing house bylaws, rules, and regulations, and the approval of members, although the clearing house prescribes qualifications for its members.

#### MERCHANDISING GRAIN

The elevator operator has to determine the best method for merchandising the grain which he carries in storage on his own account. In making his selection of market outlets, he can consider several factors: Market price conditions, condition of the grain and risk of quality deterioration while enroute, availability to market, financial conditions, type of demand, volume of movement, and many other factors, including habits and customs of the buyer. The main consideration determining the destination of grain, however, is the condition of the market, or price.

#### Country Elevators

The country elevator's grain can be sold locally, or it can be forwarded to a subterminal market, terminal market, interior mill, processing plant, or export point. Prices to local feeders generally are slightly above the terminal market price, less freight, commission, and handling charges.

When the grain is shipped to a terminal market, the country elevator's interests in the market are usually represented by a commission merchant or cash grain receiver. Grain destined for terminal markets is either consigned to a commission merchant or sold for deferred delivery on "to arrive" or "on track" bids.

In consigning grain, the country elevator ships the grain to its representative in the market to be sold after arrival in the market. Under this plan, the country elevator retains ownership of the grain, and is responsible for any loss incurred while the grain is in transit; such loss may result from adverse price changes as well as from damage to the grain. The seller thus pays all costs of shipping the grain to the market, and he does not know what price will be realized on the grain until after it arrives at the market, is inspected, and is offered for sale.

When grain is sold on a deferred shipment basis, the price is agreed on at the time the contract is made, usually before the grain is shipped from the country elevator. In addition to price, the time of shipment, grade, and terms of sale ar

specified in the deferred shipment or delivery contract. Inasmuch as the price is fixed at the time the contract is made, the country elevator is relieved of all risks incident to fluctuations in the price of grain, and the buyer assumes these risks.

Sales for deferred shipment may be made "on track country elevator point," (also identified as "track country station" or TCS), in which case the price is set f.o.b. country elevator point. In such a sale the country elevator operator agrees to load the car within a specified period. The buyer pays the cost of shipping the grain to the destination. Another common type of deferred shipment sale is the "to arrive" sale, which differs from the "on track" sale in that the price is based on delivery at the destination point; the country elevator pays the freight costs to this point.

Grain sold "to arrive" by the country elevator is usually handled in the terminal market in much the same manner as grain on consignment. The commission merchant may canvass the market for bids or he may apply the car on a previous sale.

In buying and selling grain, the country elevator operator risks loss from fluctuations in price. Part of this risk is eliminated when he sells the grain to the terminal market at the same time that he buys the grain from the farmers. Sales "on track" and "to arrive" provide a means of shifting the risk, inasmuch as the price is fixed at the time the contract is made. There are, however, definite limitations on the extent to which an elevator may hedge itself through "to arrive" and "on track" sales. "To arrive" prices do not necessarily stay in line with spot prices, and the elevator operator cannot always sell his grain by this method at a price which compares favorably with the cash price he must pay to his customers. Therefore, when a "to arrive" market is unfavorable, the elevator operator must turn to hedging in the futures market to protect himself against price fluctuations. Country elevators often employ the futures market for hedging, principally in the sale of futures against cash grain which is in transit to a terminal market for sale upon arrival, or against grain stored in the country elevator (31).

Like other hedgers, the country elevator operator is not protected against unfavorable movements of the basis, and he must use judgement and care in his hedging operations. To hedge most efficiently, the country elevator operator carefully selects the futures contract that bears the closest relationship to the grain to be hedged. As a rule, he selects the delivery month closest to the time at which he expects to sell the grain because the future grain price and the cash price at that time will be closer.

#### Terminal Elevators

Terminal elevator operators typically are short hedgers, that is, their purchases of cash grain are offset by sales of futures. These sales usually take place within a short time after the cash purchase. The delivery month chosen for the hedge sale may be the current delivery month. A later month may be chosen, however, if a better carrying charge can be earned by selling at a later time, or if there is a possibility of a change in price in the earlier month.

Initial placement of a hedge in one month does not mean that it must stay there. Changed or changing market conditions may cause the hedge to be switched to a more current month or to a later month.

If no delivery is to be made against the short future position in a current delivery month, then the hedge must be moved to a later month. This can be accomplished by

a spread order, that is an order to buy in the nearby month (thereby closing out the position in the delivery month) and sell in a deferred month (thereby establishing a new position) at either a specific difference or at the prevailing market difference when the order is placed.

Another hedging technique is the pre-hedge or anticipatory hedge. If an elevator operator feels that large cash purchases may be made overnight, this volume is estimated and an equivalent amount of futures is sold before the close of the market. This is done to protect the buying basis, that is, the relationship of the cash price to the future price. If this technique were not employed and overnight cash purchases were large, the pressure of hedge sales might force the futures well below the previous day's closing price, thereby worsening the buying basis.

If the elevator pre-hedges and then buys less cash grain than expected, it is overhedged. The hedger may either buy futures to offset the excess sales or stay short or overhedged, until enough cash purchases have been made to even up the position. Of course, if the futures the following day are lower than the pre-hedge sale price, the buying basis on later cash purchases is improved since it would be predicated on the prevailing market price.

#### GRAIN EXPORTING

Exportation of grain involves the complex problems of the domestic market, such as types, grades, and qualities of grain, futures market operations, and railroad and inland water freight rates. In addition, it requires an intimate knowledge of ocean transportation, foreign market methods and customs, and foreign exchange markets.

In buying grain for export, a typical export firm attempts to buy grain in large quantities directly from grain dealers in the larger markets. On occasion the export buyer may reach out to country elevators for his supply of grain. Another source of supply is the broker operating in the seaboard markets, who handles not only domestic business but also some export business. These brokers keep in constant touch with potential buyers and sellers of grain and bring the two parties together, receiving a brokerage fee from the seller when a transaction is completed.

Grain intended for export is usually purchased from the interior either on a "delivered to the port" basis or f.o.b. vessel at the port. In the former case the price includes costs and freight, and in the latter case the price includes cost, freight, elevation at the seaboard, outbound inspection, and weighing. The time of shipment and the route by which the grain will move to the designated port are specified when the sale is made.

If the exporter does not have terminal elevator facilities, he does not buy the export grain with the purpose of holding it for any length of time. Two general methods of purchase are employed. First, a purchase is made to fill an order; and second, a purchase is made when buying opportunities are favorable in anticipation of orders in the near future, that is, when the basis may appear attractive because of the heavy movement from first hands or because unusually low lake freights prevail.

The capacity of port elevators ranges from less than 1 million to over 15 million bushels. All grain coming into these elevators is inspected as it is unloaded from cars by inspectors licensed by the Department of Agriculture, but usually employed by a local chamber of commerce or produce exchange. Most of the grain stored in

the interior terminal elevator is for the account of the owner and the grain brought into a port elevator is mainly for the account of exporters. The main function of a port elevator is to elevate grain from cars or barges into the elevators for storage until the vessels are ready to be loaded. The elevators are equipped to handle imports of grain and can transfer incoming grain from vessels to cars or barges.

Another function of the elevator is blending and conditioning grain. This function is similar to that performed by interior terminal elevators in the domestic grain trade.

When the grain is loaded into a vessel, the grain inspector again makes an official inspection. The grade assigned is final, and sale abroad is on the basis of the official grain standards.

#### Wheat Exports

World consumption of grains for food does not fluctuate much over a short period because its principal determinants, population and per capita income, show relatively little change from year to year. A recent FAO study on grain utilization shows that in the 6-year period, 1955-56 through 1960-61, world grain consumption rose from 373 million tons a year to 438 million (12). Of the total average increase of nearly 13 million tons over the period, nearly 9 million occurred in grains for livestock feeding and 3 million in food grains. The study showed that in 1960-61 consumption of grains as food was slightly less in developed areas than it was 5 years before, as rising per capita income is associated with qualitative improvements in diet. The use of grains for food in less developed areas rose at an annual rate of 4 percent.

World exports of wheat and flour increased from 1,065 million bushels in 1955-56 to 1,855 million in 1964-65, an average annual increase of about 80 million. U.S. exports rose from 345 million bushels to 728 million during the same period, an average annual rise of about 35 million. U.S. exports as a percentage of world exports ranged from 32 to 42 percent during the 10 years, and averaged 38 percent for the period (table 4).

Government-financed exports of wheat rose from 57 percent of total U.S. exports of the commodity in 1954-55 (when P.L. 480 shipments had been underway for about 6 months) to 70 percent of the total in 1955-56. 3/ Program exports in 1962-63 reached 76 percent of the U.S. export total. During this period, exports under Government programs varied greatly. In 1963-64, exports of wheat totaled 859 million bushels, the largest quantity exported during one year by a single country. However, only 59 percent of 1963-64 wheat exports were under Government programs, and 41 percent moved for dollars.

In addition to the substantial contribution of increased exports under Government-financed programs to the rise in wheat exports, dollar sales also increased by nearly 80 percent during the period. Foreign demand for dollar exports was strengthened by the improved dollar position and the accelerated economic activity of European countries during the period. The size and quality of the European wheat crop accounted to a large extent for year-to-year fluctuations in European demand for this commodity, which were reflected in dollar exports of U.S. wheat.

3/ P. L. 480 is the Agricultural Trade Development and Assistance Act of 1954.

Table 4.--Wheat, including flour (grain equivalent): Total exports and Government exports by programs, United States, average 1954-58, annual 1955-64

Item	Year beginning July					
	Average	1955	1956	1957	1958	1959
Total exports <u>2/</u> ...	402,324	345,564	548,558	401,762	442,101	509,024
Under Government programs:						
Quantity.....	264,734	240,693	375,119	246,826	303,002	374,552
Percentage of total.....	65.8	69.7	68.4	61.4	68.5	73.6
For dollars:						
Quantity.....	137,590	104,871	173,439	154,936	139,099	134,472
Percentage of total.....	34.2	30.3	31.6	38.6	31.5	26.4
Government exports by programs:						
P.L. 480 <u>3/</u>	145,124	94,347	200,536	179,023	227,914	300,648
Title I.....	13,039	11,864	12,188	14,290	10,861	10,722
Title II.....					30,490	25,702
Title III:						
Barter.....	66,716	87,086	9,807	20,062	25,662	34,090
Donations.....	4/ 10,740	2,788	11,735	17,993	20,219	24,256
Title IV.....	---	---	---	---	---	---
Other <u>5/</u> .....	49,805	64,978	63,574	25,713	23,946	13,264
Total.....	264,734	240,693	375,119	246,826	303,002	374,552
U.S. exports as percentage of world exports....	34	32	41	34	34	42

Year beginning July  
1,000 bushels

1955 1956 1957 1958 1959 1960 1961 1962 1963 1964

Total exports 2/..... 402,324 345,564 548,558 401,762 442,101 509,024 660,882 718,982 642,271 858,697 728,099

Under Government programs: 264,734 240,693 375,119 246,826 303,002 374,552 457,720 491,072 488,980 503,414 565,885

    Quantity..... 264,734 240,693 375,119 246,826 303,002 374,552 457,720 491,072 488,980 503,414 565,885

    Percentage of total..... 65.8 69.7 68.4 61.4 68.5 73.6 69.3 68.3 76.1 58.6 77.7

For dollars: 137,590 104,871 173,439 154,936 139,099 134,472 203,162 227,910 153,291 355,283 162,214

    Quantity..... 137,590 104,871 173,439 154,936 139,099 134,472 203,162 227,910 153,291 355,283 162,214

    Percentage of total..... 34.2 30.3 31.6 38.6 31.5 31.5 30.7 31.7 31.9 41.4 22.3

Source: Wheat Situation (15).

1/ Preliminary. 2/ Totals for 1962, 1963, and 1964 include exports of "other products" and estimated relief shipments of bulgur and rolled wheat in wheat equivalent beginning 1962. 3/ The Agricultural Trade Development and Assistance Act of 1954. 4/ Army Civilian Supply Program shipments for civilian feeding in occupied areas in 1954 is included in the average shown for Donations under Title III.

5/ Agency for International Cooperation Administration.

### Rice Exports

In 1954-55, U.S. exports of rice were at a 9-year low of nearly 9 million hundredweight. In 1956-57, they increased to 27.1 million hundredweight, with Government-financed exports representing nearly 80 percent of the total. U.S. exports of rice are expected to increase to more than 32 million hundredweight in 1965-66. Since 1959, total exports have been between 20 and 32 million hundredweight. Although the greater part of the increase in earlier years was in Government program shipments, dollar sales have increased substantially. Dollar sales to Europe and Africa have shown marked increases.

During 1954-64, exports under Government-financed programs ranged from 45 percent to 66 percent of total exports, except in 1956-57 when they were nearly 80 percent of the total (table 5).

Exports of rice in terms of value were nearly 3 percent of total agricultural exports, 4 percent of Government-financed exports, and 2 percent of dollar sales during 1954-62. Exports of this grain were 6 percent of Title I and Title II shipments and 4 percent of foreign donations under Title III. Government-financed exports were slightly over half and dollar sales slightly under half of total exports in these years.

During the past 5 years, U.S. commercial exports have increased about 160 percent. Much of the expected increase in 1965-66 exports could result entirely from commercial sales. Exports have tended to increase more than domestic demand.

Table 5.--Rice, milled: U.S. exports by type of sale, year beginning July, 1954-64

Year beginning July	Under Government programs					Total exports
	For dollars	For foreign currency	Barter	Other programs	Total	
	Mil. cwt.	Mil. cwt.	Mil. cwt.	Mil. cwt.	Mil. cwt.	Mil. cwt.
1954.....	8.7	0.2	1/	0.2	0.4	9.1
1955.....	6.0	3.4	0.2	2.8	6.4	12.4
1956.....	5.6	18.0	.6	2.9	21.5	27.1
1957.....	5.9	5.1	1/	1.1	6.2	12.1
1958.....	7.5	3.9	2.0	.9	6.8	14.3
1959.....	8.0	9.9	.8	2.0	12.7	20.7
1960.....	7.2	11.9	.3	2.1	14.3	21.5
1961.....	11.2	8.2	--	1.0	9.2	20.4
1962.....	10.4	12.7	--	1.1	13.8	24.2
1963.....	16.5	13.6	--	1.7	15.3	31.8
1964 2/.....	16.1	11.2	--	1.3	12.5	28.6

1/ Less than 0.05 million cwt.

2/ Preliminary.

Source: Foreign Agricultural Service.

## Exports of Feed Grains

The use of grains for feed shows greater year-to-year variation than does utilization of grains for food, principally due to changes in production of grain, livestock numbers, and supply of nongrain feeds. The FAO study of grain utilization during the 6-year period, 1955-56 through 1960-61, shows that of the increase of 13 million tons per year in world utilization of grains, 9 million tons were increased uses for feed. This upward trend was primarily the result of larger quantities fed per animal unit, especially in the United States and in some other countries, of increasing livestock numbers in Europe and some other areas, and of the favorable price relationship between feed grains and livestock products.

The FAO study indicated that in Western Europe, which is the principal market for U.S. exports of feed grains, most of the increase in feed grain consumption was due to rising livestock numbers, especially of hogs and of poultry for meat production. Cattle numbers have remained relatively constant, but cattle have been fattened to a greater extent than usual in the last few years (13).

World exports of feed grains increased from 19.5 million tons in 1956-57 to 39.6 million in 1964-65, an average annual increase of about 2 million. U.S. exports generally followed the same upward trend, rising from 7 million tons in 1956-57 to almost 20 million in 1964-65, an average yearly rise of about 1.4 million. U.S. exports climbed from 36 percent of the world total to 50 percent in this period and averaged 49 percent for the last 7 years (table 6).

Year-to-year fluctuations in U.S. exports of feed grains were generally due to the degree of availability of supplies in competing exporting countries, to the size of the

Table 6.--Feed grains: Total exports and exports under Government programs, United States, July-June 1956-67 to 1964-65

Program	1956-57	1957-58	1958-59	1959-60	1960-61	1961-62	1962-63	1963-64	1964-65
----- <u>1,000 short tons</u> -----									
-----									
Public Law 480...:	3,575	1,996	2,631	3,375	3,128	3,892	2,320	2,029	1,876
AID 2/.....:	522	280	16	314	493	70	14	2	11
Other exports 3/:	2,683	7,025	9,443	9,184	9,104	12,290	14,594	15,761	18,043
Total 4/.....:	5/6,780	5/ 9,301	12,090	12,873	12,725	16,252	16,928	17,792	19,030
Deliveries from :									
CCC stocks :									
under Payment-:									
in-kind Program:									
6/.....:	--	--	1,120	809	1,457	1,476	1,272	1,221	946
----- <u>Percent</u> -----									
U.S. exports as :									
percentage of :									
world exports...:	36	44	49	49	48	48	50	48	50

1/ Preliminary.

2/ Financed with foreign aid funds by Agency for International Development.

3/ Grain exported from commercial channels under Payment-in-kind Program and unassisted commercial sales for export.

4/ Total exports, including grain equivalent of products.

5/ Includes substantial quantities coming from CCC stocks under Payment-in-Kind Program.

6/ Deliveries from CCC stocks to exporters for export under Payment-in-Kind Program, including payments for exports under Public Law 480.

Source: Feed Situation (13).

European feed grain crop, and to the milling qualities of the European wheat crop which determined the extent of utilization of European-grown wheat for feed.

Expansion in demand for livestock and livestock products in Western Europe has been one of the important factors in the increase in U.S. exports of feed grains during the past 10 years. While feed grain production in recent years has been about a fourth larger than in the late 1950's, requirements have increased at an even faster pace. The uptrend in demand has resulted from the marked economic growth in Western Europe during the past 15 years.

Mixed feed production in Western Europe increased from 19 million tons in 1957 to almost 40 million in the middle 1960's. This rapid growth in the mixed feed industry has been a major factor in the increased demand for imported feed grains and high-protein feeds. Despite the increase in feed grain production during this period, Western European imports of feed grains from all countries increased from 13 million tons in 1956-57 to about 25 million in 1964-65. Imports of feed grains from the United States kept pace with the increase in total imports, rising from less than 5 million tons to around 11 million. Demand for feed grains and high-protein feeds in Western Europe is expected to continue to expand, with further growth in the economies of these countries.

In contrast to some food commodities (such as wheat, rice, soybean oils, and dairy products), most exports of feed grains move through commercial channels without Government assistance. Of the 19.9 million tons of feed grains exported in 1964-65, nearly 90 percent were exported by private firms exclusive of Government aid. Practically all of the remaining 1.9 million tons were shipped under P. L. 480, down slightly from a year earlier (14).

Corn exported in 1964-65 under P. L. 480 totaled 51.5 million bushels, about a fifth below that in 1963-64. Corn export sales for long-term dollar credit increased to 11.5 million bushels, while sales for foreign currency and foreign donations were down sharply from the year before.

There have been no payments for exporting feed grains under the Payment-in-Kind Program during the last 3 years. Feed grains, however, are delivered to exporters under this program from CCC stocks in payment for export of other agricultural products. The tonnage delivered for export dropped from 1,221,000 tons in 1963-64 to 946,000 tons in 1964-65 nearly a fourth. Corn and barley exports under this program were down sharply and more than offset the increase in oat and sorghum grain shipments.

World feed grain exports have more than doubled in the past decade. World exports in 1964-65 totaled about 40 million tons, nearly 3 million more than the year before and around 22 million above the 1953-57 average. U.S. exports have increased at a little faster rate than the world total, going to slightly over half the world total in 1964-65. Feed grain exports by Argentina, France, and the Republic of South Africa have expanded considerably in the past few years, while Canadian and U.S.S.R. shipments have declined. Australian exports have varied during this period.

U.S. exports of feed grains are expected to rise. The export trend is expected to continue, based on expansion of feed requirements in Western Europe and other major importing countries.

## PROCESSORS

The more important processors of grains and grain products are flour millers, bakers, rice millers, wet and dry processors of corn, oats millers, maltsters,

distillers, and mixed feed manufacturers. The principal grain used by flour millers is wheat, and the leading product is flour, with its byproducts of bran and middlings. Flour is then used by the baking industry to make bread, cakes, etc., for the consumer. Mill byproducts are used by the mixed feed industry. Rice millers process the rough rice into milled, whole, and broken rice for human consumption; byproducts go into livestock feeds.

Wet processors of corn use shelled corn in the manufacture of a diversified group of products including starch, dextrin, corn sirup, corn sugar, corn oil, and feeds. Dry processors of corn use yellow shelled corn in the manufacture of granulated yellow cornmeal, bolted yellow cornmeal, and yellow corn flour; they use white shelled corn in the manufacture of pearl hominy, brewers' grits, granulated white cornmeal, bolted white cornmeal, and white corn flour. The principal products of the oats millers are rolled oats, steel-cut oatmeal, and ground oatmeal. Maltsters use barley in the preparation of malt, which is a grain whose starch content has been converted into a form of sugar through a process of sprouting or growing. Malt is used in the distilling and brewing industries.

Corn and barley malt are principal grains used in the distillation of whiskey and high proof alcohol or neutral spirits. Wheat, corn, oats, barley, and sorghum are used in the preparation of mixed feeds for poultry, horses, hogs, dairy and beef cattle, and household pets.

#### Grain Purchasing

Steps in grain marketing are completed when processors purchase grain. Wheat, rice, corn, oats, barley, and sorghums are all used in the manufacture of grain products. With some grains most of the crop is processed, whereas with others the bulk of the crop is used for livestock feeding. In purchasing grain, a processor selects the type, variety, and grade adapted for making his particular product and, wherever possible, hedges his purchase of grain and sales of grain products by counterbalancing sales and purchases in the futures market.

The different types of processing industries employ varying methods in the purchase of their grain; varying methods are employed even within the same industry. Some processors purchase a small amount of grain directly from farmers, and some grain is bought directly from country elevators. The great bulk is purchased in the terminal markets. Some of the processors have plants located in the surplus grain areas, and are able to draw their grain requirements mostly from the immediate vicinity. The larger processors have additional plants located in manufacturing areas and draw their supplies from considerable distances. Therefore, they find it desirable to purchase the bulk of their supplies in the terminal markets. Perhaps the most important advantage of purchasing grain in the terminal markets is that these markets can usually offer a large amount of grain either on spot or out of terminal elevators at any time the processor wishes to make a purchase. The processor can make a better selection of his grain on the terminal market because of the higher quality offered to him.

Some of the larger processors retain their own buyers in the terminal markets to purchase grain from cash grain commission merchants or terminal elevators, wherever the most advantageous price can be obtained. Other processors purchase supplies in terminal markets through brokers, while another group of processors buy solely from terminal elevators or grain merchandisers and do not have their own representatives in the market.

Processors usually do their heaviest buying at harvesttime when crops are moving. A wider selection of grades can be obtained at this time, thus making it easier for the processor to obtain the qualities of grain desired. The extent to which a processor is able to purchase supplies is limited somewhat by storage capacity, although at times additional storage space can be rented.

Most processors are in the market buying grain throughout the entire year. Grain purchasing by some processors, however, is seasonal. For example, the malting industry customarily closes its plants about June 1 for the summer months. Maltsters buy heavily in the fall, but in the spring, purchases taper off.

The processor's biggest problem in selecting grain is to obtain the type and grade required for his particular product. There are numerous aids to the processor in selecting his grain, and how he uses them depends on how exacting his requirements are. His first guide is the Federal grading system; some processors can rely solely on the Federal grades in purchasing their raw material. Another aid is appraisal by an experienced buyer. By examining the general appearance and soundness of the grain, an experienced buyer can determine certain qualities that may not be described by U.S. grade designations. Further assistance is given to the processor by tests for qualities not included in the Federal grain standards. Some tests are made under conditions similar to those of the actual process, and show how the particular lot of grain will react when it is milled or processed.

#### Flour Milling

Flour milling in the United States reached its alltime peak for several years following World War II. Large quantities of flour were shipped abroad while damaged mills were being replaced. Postwar liquidation of excess milling capacity began in 1948 when the European flour demand fell to almost zero from the high level which prevailed through several seasons (35). Flour milling, which had been running close to 25 million hundredweight per month, declined to 20 million hundredweight in a short time. This led to the closing of many flour mills.

During the following 5 years, 132 flour mills, with aggregate capacity of 245,000 hundredweight per month, became idle. However, during this period five new mills and additions to existing plants added about 87,000 hundredweight to the capacity of the industry.

After 1955, production potential increased and has continued to rise to the present. Total milling capacity rose about 4 percent from 1955 to 1964, and flour production increased about 18 percent.

Many extensive and far-reaching changes have taken place in this industry which many outsiders might assume to have been static ones (35). The transition of the wheat-milling industry began in the 1920's with the shift in demand from family flour to commercial flour. The result was a decline in the number of small milling firms that served the family flour market. Total quantity of flour milled has remained relatively constant over the years, but the trend has been toward fewer and larger millers. Concentration within the industry has been increasing.

According to the Census of Manufactures, 703 companies manufactured flour and meal in 1958 (table 7). This was about two-thirds as many as in 1947. In 1963 there were about one-third as many establishments with 20 or more employees as there were in 1939.

Table 7.--General statistics for the flour mills in the United States, selected years, 1939-63

Year	Companies	Establishments			Production workers			Value added			Capital expenditures, new		
		With 20 or more employees		Persons employed	Persons employed		Man-hours	Wages	by manufacture	Cost of materials	Value of shipments	Value of new	
		Number	Number	Number	1,000 dollars	Number	Thou.	1,000 dollars	1,000 dollars	1,000 dollars	1,000 dollars	1,000 dollars	
1939 1/.....	NA	2,143	NA	35,978	49,375	24,771	NA	28,370	143,882	506,061	649,943	NA	
1947 1/.....	1,047	1,243	393	39,597	119,533	30,821	NA	86,000	410,774	2,115,872	2,526,646	NA	
1954 1/.....	692	803	260	28,969	119,844	21,447	47,919	83,813	330,634	1,671,996	2,002,227	15,240	
1958.....	703	814	250	28,215	140,121	20,519	44,111	96,165	393,053	1,693,756	2,086,706	22,109	
1963.....	NA	617	218	22,400	137,647	16,465	38,374	94,836	382,546	1,803,922	2,185,846	23,615	

1/ Data for Alaska and Hawaii are not included.  
 NA Not available.

Source: U. S. Census of Manufactures (42).

Flour and meal industries employed only 62 percent as many employees in 1963 as in 1939; however, the payroll was about 2.6 times its 1939 size. Production workers decreased about 35 percent and payroll was about 2.3 times as large in 1963 as in 1939. Cost of materials and value of shipments also were about 2.3 times as large in 1963.

Changes in the flour-milling industry were not uniform among regions (table 8). The greatest decreases in number of establishments took place in the Northeast, North Central, Mountain, and Middle Atlantic Regions, which had only about one-third as many establishments in 1963 as in 1939. Establishments in the Pacific Region during this period declined to about 65 percent of those in operation in 1939.

Output per man-hour in the flour-milling industry has increased rapidly as a result of innovations in milling processes. The milling industry also developed and effectively promoted sales of new products such as prepared mixes. Innovations in the milling industry have been part of the effort to overcome the situation of over-capacity and a changing market for its product.

#### Baking Industry

The American baking industry, which comprises 20,000 establishments, the vast majority of which are small independent retail bakers. The various segments are identified as retail, wholesale, house to house, chainstore, and cracker bakers (20).

The baking industry, which consumes tremendous quantities of flour, milk, butter, eggs, and animal and vegetable shortening, is one of the farmer's largest customers. It is one of the largest truck-operating industries and is probably the largest user of delivery trucks in the United States. The industry is the second largest employer among the food industries, accounting for an estimated 17 percent of the workers in those industries. Efficiency of methods and improved machinery have been reflected in the decreasing number of people required to produce a given quantity of baked goods. Numerous technological developments in the past 25 years have changed the system of production from one of "gravity"--raw materials put in on the top floor and finished products on the ground floor--to a one-level operation (20).

The perishability of certain bakery products has tended to limit the market served by a single producer. This undoubtedly accounts for the prominence of the small independent retail bakers. However, continued improvements in transportation have widened the market which may be served by the individual firm, and, as in the case of other business firms, the small bakery has been pressed to keep abreast of technological and managerial advances.

In 1948, the Bureau of Labor Statistics indicated there was a total of 1,801,000 employees in the 21 manufacturing industry groups in the bread classification of "Food and Kindred Products." In 1956, there was a slight increase to 1,842,000. From then on there was a slight but consistent decline to 1964, when the total was 1,730,000. Production workers accounted for 1,374,000 in 1948 and declined steadily until 1964 to 1,144,000.

Mechanization has played an important role in the industries operations. Contrary to the general trend of most food industries there was no overall change in the total number of persons on bakery payrolls. There were 288,000 employees in 1948; the number was 304,000 by 1956. After 1956 there was a moderate decline to 288,000 in 1964. During this same period production worker numbers dropped from 205,000 in 1948 to 166,000 in 1964.

Table 8---U.S. flour mills: Number of establishments and value of shipments, by regions, selected years, 1939-63

Region	Establishments				Value of shipments			
	1939	1947	1958	1963	1939	1947	1958	1963
	Number	Number	Number	Number	1,000 dollars	1,000 dollars	1,000 dollars	1,000 dollars
Northeast and Middle Atlantic..	284	152	85	74	89,400	293,385	247,868	251,375
South Atlantic...	434	273	232	162	39,326	101,440	88,592	59,451
North Central...	803	458	227	183	333,415	1,398,436	1,126,776	1,293,356
South Central...	388	240	180	122	96,387	395,776	287,173	276,219
Mountain.....	142	73	43	37	23,238	117,529	120,820	110,719
Pacific.....	72	47	47	39	61,348	204,977	215,477	185,409
United States...	1/ 2,143	1,243	814	617	1/ 649,943	2/ 2,526,646	2,086,706	2,176,529

1/ Total includes 20 mills omitted from regional classification.

2/ Adjusted total for United States but not for regions.

Source: U. S. Census of Manufactures (40, 42).

This decline was at a somewhat greater rate than the decline for all food workers. Automation or mechanization is the primary explanation for the moderate contraction in the number of plant workers needed to supply the increased population with a modest increase in demand for bakery products. This has been accompanied by another development--in all brackets of the business, large or small, wholesale or retail, more of the output is being produced by about the same number of larger bakery units. Population growth over the last 15 years, together with increased incomes and higher standards of living, provided the impetus for output in the food industry group to increase by more than 50 percent from 1948 to 1964.

Entry of grocery chain firms into the baking industry has had considerable impact. The grocery chain, by various methods, can achieve considerable economies in distribution which other wholesalers have as yet found difficult to match. This has stimulated much interest within the industry in distribution costs.

The baking industry has adopted a number of changes to reduce costs of operations. Wholesale bakers have streamlined production by bulk handling of flour, and by a continuous-mix method of preparing products for baking.

Preserving bakery products by freezing is another growing practice. To date, freezing has made its greatest advances in sweet goods such as cakes and pies. It is being used to a limited extent in the distribution of bread. The use of radiation is in prospect for increasing the marketing life of bread. Innovations that tend to lengthen the marketing life of the finished product may be the greatest hope of the industry for increasing its efficiency. If freezing and radiation prove useful in lengthening the marketing life of bread products, then the baking industry could be on the threshold of significant cost-reducing changes in distribution.

The baking industry accounts for roughly 50 percent of the wheat used for food. The remainder of food wheat is used in crackers, cookies, macaroni products, breakfast cereal, flour mixes, and other items. While the baking industry has maintained its share of wheat used for food, production has shifted from single-unit retail bakers to wholesale bakers (47).

The number of wholesale bakeries has increased while the number of home service and retail multiunit bakeries has decreased. It appears that the number of wholesale bakeries is lower than was reported in the late fifties. Sales through vertically integrated grocery chains do not appear to be increasing to any great extent--they probably account for about 10 percent of total industry sales. Most bakery manufacturing chains appear to be limited to food chains that have a large enough volume of sales to efficiently utilize a bakery manufacturing plant (41).

The number of firms in the bread and related products industry declined during the postwar period (table 9). In 1947, there were 6,796 firms; in 1958, 5,985; and in 1963, 5,003. The number declined in every segment except in grocery chain bakeries. During this period, the average value of shipments increased for every type of manufacturing establishment.

The decline in numbers of bakeries has been accompanied by an increase in the average size of the remaining bakeries. The decline occurred primarily in bakeries employing under 100 persons. Bakeries employing over 100 persons have increased in number. It was estimated that a real increase in sales for the average bakery from 1947 to 1958 amounted to \$13,000 per bakery (47).

The baking industry has experienced some vertical integration. Firms engaged in grocery merchandising have entered the bakery manufacturing industry through acquiring and operating their own bakery plants. This has been one of the major changes in the postwar baking industry. As mentioned earlier, this subgroup of the industry is the only one that increased in number of establishments during post-World War II period.

#### Rice Milling

The number of rice mills was about the same in 1963 as in 1939, according to the Census of Manufactures (table 10). Numbers fluctuated from 72 in 1939 to about 100 in the early fifties, and back to 74 in 1963 (16, 42).

Numbers of all employees increased 32 percent and of production workers, 38 percent, a trend contrary to that in the flour and baking industries. Payroll for all employees in rice milling was about 5.5 times as large in 1963 as it was in 1939, value added by manufacture was slightly over 8 times as large, and cost of materials and value of shipments was 10 times as large.

#### Cereal Processing

As compared with some food industries, the cereal or prepared breakfast foods industry is a small outlet for farm products. Yet it is an important outlet to the farmer supplying high-quality food grains used by the industry. Breakfast foods are also important to manufacturers, even though in some cases cereals may account for only a small portion of their total sales. In the middle sixties, consumption of breakfast foods in the United States was about 1.7 billion pounds or nearly 10 pounds per

Table 9.--General statistics for the bread and related products industry in the United States, 1947, 1958, and 1963

Year	Establishments			All employees			Production workers			Value added			Cost		
	With 20 or more employees			Persons employed			Persons employed			by manufacture			of materials		
	Total	Persons employed	Annual payroll	Man-hours	Wages	Value added	Total	Persons employed	Man-hours	Wages	by manufacture	of materials	Value of shipments		
1947 1/	6,796	NA	232,726	654,776	149,519	325,580	350,056	1,098,012	1,305,577	2,403,589					
1958	5,985	2,149	257,846	1,158,062	145,933	297,470	574,696	2,119,818	1,994,991	4,098,612					
1963	5,003	1,899	237,975	1,300,298	129,766	267,694	644,587	2,371,713	2,102,156	4,473,066					

1/ Data for Alaska and Hawaii are not included.  
NA Not available.

Source: U.S. Census of Manufactures (42).

Table 10.--General statistics for the rice milling industry in the United States for selected years, 1939-63

Year	Establishments			All employees			Production workers			Value added			Cost		
	With 20 or more employees			Persons employed			Persons employed			by manufacture			of materials		
	Total	Persons employed	Annual payroll	Man-hours	Wages	Value added	Total	Persons employed	Man-hours	Wages	by manufacture	of materials	Value of shipments	new 1/	
1939 2/	72	NA	3,218	3,094	2,346	NA	1,533	8,561	33,802	42,363					NA
1947 2/	88	59	4,072	9,999	3,267	7,788	6,700	43,432	181,309	224,741					NA
1954 2/	80	58	3,964	13,367	3,129	7,145	8,397	44,304	231,284	273,770					3,538
1958	72	51	3,843	14,286	2,903	5,982	8,976	53,152	262,304	312,061					1,442
1963	74	49	4,256	20,255	3,243	7,315	12,706	79,674	351,063	423,017					3,325

1/ Includes expenditures for plants under construction but not in operation.  
2/ Data for Alaska and Hawaii are not included.  
NA Not available.

Source: U.S. Census of Manufactures (42).

person. Manufacturers' sales were an estimated \$500 million and retail sales considerably larger (24). According to a supermarket study of 40 product groups, over 3 percent of the dollar margin of the grocery department was derived from the sales of breakfast foods. Breakfast foods ranked fourth--behind health and beauty aids, canned fish, and snack-party foods--in gross profit per retail-shelf foot (30).

Industry growth between 1939 and 1963 was in size of companies rather than in numbers. In the 1960's, an estimated 80 percent of the dry cereal market was shared by three large companies (34), although the numbers of establishments, all workers, and production workers increased 14 percent from 1958 to 1963 after declining steadily since 1939 (table 11).

Value added to shipments by manufacturers has increased steadily both absolutely and relatively (table 11). In 1947, the value added was 46 percent of the total value of shipments and in 1963, 58 percent.

Value added in relation to total value of shipments is higher for breakfast foods than for any of the other grain mill products. Three important reasons for this are (1) the high degree of processing, (2) the large quantity of other food ingredients added, and (3) the additional labor and equipment costs required for packaging (30). Both value of shipments and value added by manufacturers increased over fourfold from 1939 to 1963.

Total consumption of breakfast foods increased after 1939, but the rate of increase was slightly less than the rate of population growth until about 1958. Since then, the increase in total consumption has been about equal to population growth or about 1.8 percent a year (30). Thus, population growth has been a major factor in the industry's growth in recent years.

From 1939 to the present, the demand for ready-to-eat breakfast foods has increased steadily while the demand for cooked breakfast foods has declined. Many small manufacturers in the South and Middle Atlantic States who did not or could not make the change to ready-to-eat breakfast foods were forced to drop out of the industry. They could not compete with newer and larger establishments, which apparently could operate at lower unit costs and had economies of scale that more than offset greater distribution costs. A change in the type of corn available to the industry--from white to yellow--also affected some small Southern and Middle Atlantic manufacturers (30).

#### Mixed-Feeds Industry

Some of the more important trends in the mixed-feeds industry have been increased demand and production of formula feeds, integration of the mixed-feeds industry with livestock production, direct sales to farmers, increased size of farms and livestock production units, bulk delivery of mixed feeds, and growth of on-farm and custom mixing. Many of these changes have affected the economic position of firms as well as their individual production operations.

The structure of the mixed-feeds industry has also changed greatly during the past 15 years. During this period, the total number of feed-mixing facilities increased, and the average size of mills decreased. There were numerous mergers and consolidations, plant closures, various types of integration including contract livestock production, changes in livestock production areas, shifts in transportation methods, and increased demand for services by customers. Competitive relationships changed within and among regions.

Table 11.—General statistics for the cereal preparations industry in the United States for selected years, 1939-63

Year	Establishments			All employees			Production workers			Value added			Cost of materials			Value of shipments			Capital expenditures, new 1/			
	With 20 or more employees	Persons employed	Annual payroll	Persons employed	Man-hours	Wages	by manufacture	Value added by manufacture	Wages	by manufacture	Value added by manufacture	Wages	by manufacture	Value added by manufacture	Wages	by manufacture	Value added by manufacture	Wages	by manufacture	Value added by manufacture	Wages	by manufacture
	Number	Number	Number	Number	Number	1,000 dollars	Thou.	1,000 dollars	Thou.	1,000 dollars	Thou.	1,000 dollars	Thou.	1,000 dollars	Thou.	1,000 dollars	Thou.	1,000 dollars	Thou.	1,000 dollars	Thou.	1,000 dollars
1939 2/	70	NA	9,033	13,647	7,458	NA	9,857	70,349	58,034	128,383	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1947 2/	64	NA	11,276	30,689	9,496	19,540	25,160	130,188	154,478	284,666	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
1954 2/	46	27	11,534	51,002	9,149	18,211	38,062	177,171	188,004	365,728	4,403	4,403	4,403	4,403	4,403	4,403	4,403	4,403	4,403	4,403	4,403	4,403
1958	43	25	10,927	61,902	8,490	16,803	44,101	243,088	202,045	444,132	17,674	17,674	17,674	17,674	17,674	17,674	17,674	17,674	17,674	17,674	17,674	17,674
1963	49	31	11,998	79,242	9,986	19,954	60,873	390,579	287,757	673,590	12,696	12,696	12,696	12,696	12,696	12,696	12,696	12,696	12,696	12,696	12,696	12,696

1/ Includes expenditures for plants under construction but not in operation.  
 2/ Data for Alaska and Hawaii are not included.  
 NA Not available.

Source: U.S. Census of Manufactures (42).

Table 12.—General statistics for the prepared animal feed industry in the United States for selected years, 1939-63

Year	Establishments			All employees			Production workers			Value added			Cost of materials			Value of shipments					
	With 20 or more employees	Persons employed	Annual payroll	Persons employed	Man-hours	Wages	Persons employed	Man-hours	Wages	Persons employed	Man-hours	Wages	Persons employed	Man-hours	Wages	Persons employed	Man-hours	Wages			
	Number	Number	Number	Number	Number	1,000 dollars	Number	Thou.	1,000 dollars	Number	Thou.	1,000 dollars	Number	Thou.	1,000 dollars	Number	Thou.	1,000 dollars			
1939 1/	1,383	NA	24,177	31,803	15,401	NA	16,253	99,240	302,640	302,640	302,640	302,640	302,640	302,640	302,640	302,640	302,640	302,640	302,640	302,640	302,640
1947 1/	2,688	NA	55,152	142,562	40,115	NA	93,124	393,049	1,719,192	1,719,192	1,719,192	1,719,192	1,719,192	1,719,192	1,719,192	1,719,192	1,719,192	1,719,192	1,719,192	1,719,192	1,719,192
1954 1/	2,292	685	59,890	225,199	41,290	91,220	138,520	629,963	2,354,603	2,354,603	2,354,603	2,354,603	2,354,603	2,354,603	2,354,603	2,354,603	2,354,603	2,354,603	2,354,603	2,354,603	2,354,603
1958	2,379	715	57,313	252,346	38,010	81,406	151,819	798,892	2,444,799	2,444,799	2,444,799	2,444,799	2,444,799	2,444,799	2,444,799	2,444,799	2,444,799	2,444,799	2,444,799	2,444,799	2,444,799
1963	2,587	711	55,061	280,003	34,853	76,163	160,084	919,604	2,919,228	2,919,228	2,919,228	2,919,228	2,919,228	2,919,228	2,919,228	2,919,228	2,919,228	2,919,228	2,919,228	2,919,228	2,919,228

1/ Data for Alaska and Hawaii are not included.  
 NA Not available.

Source: U.S. Census of Manufactures (42).

During early years, feed was marketed primarily through local grain elevators. These local elevators were frequently owned and operated by large flour millers who supplied the milling industry with byproducts sold as feed. After the turn of the century, feed manufacturers began mixing other ingredients with the grain and by-products to produce specialized formula feeds. Since World War II, most of the feed formulas have come to contain between 15 and 25 ingredients, microingredients, and drugs (3).

The industry today was created by and grew largely as a result of nutritional research which showed how production of poultry and livestock and their products could be increased per unit of feed by addition of certain microingredients such as vitamins, antibiotics, hormones, and coccidiostats. Nutritional research in the past 15 years has enabled the livestock producer to obtain greater production with much less feed.

An important trend in the mixed-feeds industry has been toward decentralization of production--away from the mill in the central market to the smaller, more specialized, demand-oriented mill. At the same time, there is great evidence of concentration as well as integration within the mixed-feeds industry (46).

According to the 1963 Census of Manufactures (42), 47 million tons of complete feeds and 10.3 million tons of concentrates were produced in 1963.

Comparison with previous years is difficult since the 1963 census was expanded for more complete coverage of the industry. The number of commercial mixers was estimated to be in excess of 9,000.

However, the Census of Manufactures supplies data which illustrate some of the major trends (table 12). From 1939 to 1963, the total number of establishments increased about 90 percent. Numbers of employees and of production workers more than doubled during the 25-year period. Establishments with 20 or more employees increased about 4 percent from 1954 to 1963.

Value added by manufacture increased at about the same rate as the annual payroll; it was 9 times as large in 1963 as in 1939. Cost of materials and value of shipments became more than 8 times larger during this period.

The greatest growth in number of plants between 1939 and 1963 occurred in the South Atlantic and South Central States--there were between 3 and 4 times as many in 1963 as in 1939. The number in the Middle Atlantic States declined about 10 percent. The greatest increase in value of shipments occurred in the South Atlantic States and the smallest in the Middle Atlantic Region.

The American Feed Manufacturers Association in its annual survey of members found that 1964 tonnage was about 12 percent above 1960 tonnage. The report shows that complete feeds accounted for about 65 percent of total commercial feed produced, a decrease of 3 percent since 1960 (table 13). Complete feeds in 1964 were 98 percent of all feeds produced in New England and 93 percent of those produced in the Pacific Region. These were the largest percentages in any region since 1960. The West, North Central and East North Central areas, with about 35 percent each, had the lowest percentages of complete feeds during this period.

The proportion of mixed feeds sold in bulk increased in all regions between 1960 and 1965 (table 14). In 1965, the South Atlantic, East South Central,

Table 13.--Commercial formula feed: Complete feed as a percentage of total produced, by region, 1960-65

Region	Complete feed as a percentage of commercial formula feed					
	1960	1961	1962	1963	1964	1965
	Percent	Percent	Percent	Percent	Percent	Percent
New England.....	97	97	98	98	98	98
Pacific.....	92	92	94	91	93	94
South Atlantic.....	84	83	83	82	86	88
Middle Atlantic.....	83	85	85	77	87	86
West South Central.....	78	76	78	72	74	77
East South Central.....	71	71	72	64	74	78
Mountain.....	62	53	60	62	51	52
West North Central.....	42	39	32	31	31	35
East North Central.....	41	35	33	30	37	36
United States.....	68	65	64	60	64	66

Source: American Feed Manufacturers Association.

Table 14.--Commercial formula feed: Percentage distributed as bulk, by region, 1960-65

Region	Bulk distribution					
	1960	1961	1962	1963	1964	1965
	Percent	Percent	Percent	Percent	Percent	Percent
South Atlantic.....	57	64	65	69	71	76
East South Central.....	55	63	65	67	65	71
Pacific.....	60	65	69	63	64	68
Mountain.....	32	37	73	50	59	61
New England.....	31	42	47	50	50	56
West South Central.....	41	45	48	48	52	57
Middle Atlantic.....	32	34	44	41	49	55
West North Central.....	25	28	28	30	32	36
East North Central.....	20	22	26	28	33	37
United States.....	38	42	46	47	50	55

Source: American Feed Manufacturers Association.

and Pacific Regions had the highest percentage of feed delivered in bulk, between 68 and 76 percent. The West North Central and East North Central Regions had the lowest percentages of bulk deliveries, 36 and 37 percent, respectively.

The marketing of mixed feeds has been changing rapidly, but there has been no clear-cut pattern. Firms in the industry have moved in several directions in an attempt to adjust to customer demands and competition.

Feed distribution through retail dealers was the main channel used by the major feed companies for many years. Some firms still emphasize this method of distribution. However, in recent years it has been partially discarded by other firms, which have been dropping the least efficient dealers.

The majority of firms in the mixed feeds industry now make direct sales to the farmer, a system which for many years was used to only a limited degree. Quite a number of regional firms have decided that this channel is the better route for meeting competition and changing market conditions. This custom will no doubt continue to grow in popularity.

Another trend in the mixed-feeds industry has been the shift by livestock producers to on-farm mixing of feeds and to purchase of feeds through organized buying groups. In certain areas of the United States, the larger livestock and poultry feeders have gone to on-farm mixing of feeds for a number of reasons. Lower cost feed and improved service are the most important reasons. Many times local feed dealers are not able to satisfy the feeders' demands.

Farmer buying pools have been organized to purchase either feeding ingredients or mixed feeds at cost plus handling or processing. Consolidated purchases have tended to reduce the margins of the feed manufacturers as well as to intensify the competitive nature of the industry.

Contracting and other types of integration in the mixed-feeds industry have been closely aligned with the changes in marketing and livestock and poultry production. The poultry industry has moved rapidly in this direction. Livestock producers and firms supplying this group have tended to move more cautiously. Feed manufacturers and associated businesses are placing considerable emphasis on vertical integration. The move to integration of overall operations has been made by feed manufacturers, hatcheries, livestock and poultry processors, and others in the long chain between the producer and the consumer.

#### Wet Corn Milling

Wet corn millers, also known as corn refiners, manufacture starch, starch derivatives, sirup, feed, and oil. They differ markedly from other processors of corn. There are few wet millers, and their plants are larger and located mostly in the Corn Belt. Yellow corn is used primarily and may be of fairly high moisture content. In the refining process, a large quantity of water is used for separating various parts of the kernel.

The main product of corn refining is starch; however, there are several byproducts. Starch is manufactured in many modifications for a host of food and nonfood uses. Dried starch is processed by various combinations of heat, pressure, time, and chemicals into adhesive products called dextrans. Wet starch is converted chemically into sirups or sugars. Sirups are made in liquid and dried form to meet specifications of the user. Corn sugar is produced in numerous types, from crude to a refined product such as dextrose that has many medical uses.

The corn-refining process yields a number of important byproducts. Corn oil is obtained from the germ, either by pressure or by solvent extraction methods. Corn gluten feed contains gluten, corn solubles, and parts of the hull. Gluten meal contains most of the gluten or protein. Corn oilcake meal is the ground dried residue of the corn germ after practically all of the oil has been removed. Corn gluten feed, gluten meal, and oilcake meal are valuable feedstuffs used by commercial mixed-feed manufacturers in livestock and poultry rations. The corn sugar refining process yields a byproduct called hydrol or corn molasses. It is used primarily by mixed-feed manufacturers, and to a lesser extent in the manufacture of food products (8).

In 1964, 11 manufacturers processed more than 190 million bushels of corn. This was roughly 5 percent of the 1964 corn crop. These companies produce about 6 1/2 billion pounds of starch each year. About 50 percent of this total is converted to corn sirup, over 30 percent is marketed as starch and dextrin, and the remainder goes into corn sugar (9).

Coproducts of this process include over 350 million pounds of corn oil and about 1 1/2 million tons of livestock feed.

The wet corn milling industry has only a few establishments--there were 35 in 1939, 59 in 1958, and 59 in 1963 (table 15). The number of larger establishments with 20 or more employees increased from 21 in 1954 to 26 by 1958 but dropped in 1963 to 20. From 1939 to 1963, the total number of employees increased about 47 percent. In 1963, the number of employees was slightly below the high of 1958. Number of production workers tended to follow the same trend except that the highest level of employment was in 1954. There were about 45 percent more production workers in 1963 than in 1939.

Value added in 1963 rose to about 4.5 times the amount added in 1939. Cost of materials and value of shipments were about 4 times as high in 1963 as in 1939. Value added in 1939 accounted for about 44 percent of value of shipments and increased to about 47 percent in 1963.

#### Dry Corn Milling

Unlike the wet-processing corn industry, the dry-processing corn industry comprises hundreds of mills, large and small, scattered throughout the States where corn is raised.

The processes of dry corn milling are closely related to those of wheat-flour milling. The essential difference between the two is in objectives. In flour milling, the raw material is reduced to flour as soon as possible, whereas in corn milling, the products of the early stages of reduction are worth more than the flour.

The most important dry milling product is cornmeal, which is made from degermed and hulled kernels. Removal of the germ increases the shelf life of the meal. Corn flour results from grinding and bolting the grain until the granules are as fine as those of wheat flour. Corn flour resembles cornstarch in appearance.

Hominy or grits consists of coarsely ground corn kernels from which most of the hulls and germ have been separated. Corn flakes are made by rolling grits after they have been flavored with malt, sugar, and other ingredients. Brewers use meal, grits, and flakes in the manufacture of beer.

Table 15.--General statistics for the wet corn milling industry in the United States for selected years, 1939-63

Year	Establishments		All employees		Production workers		Value added		Value of shipments	
	With 20 or more employees		Persons employed		Persons employed		by manufacture			
	Number	Number	Number	1,000 dollars	Number	1,000 dollars	1,000 dollars	1,000 dollars		
1939 1/	35	NA	9,024	15,726	6,764	NA	10,586	52,493	66,913 119,406	
1947 1/	55	NA	12,324	41,115	10,158	23,032	32,688	127,143	332,835 459,978	
1954 1/	58	21	13,565	60,030	10,584	21,008	43,172	178,722	285,806 463,548	
1958	59	26	13,792	78,767	10,385	22,241	56,335	249,435	282,040 528,530	
1963	59	20	13,237	89,746	9,830	20,904	65,304	290,792	335,834 622,338	

1/ Data for Alaska and Hawaii are not included.  
NA Not available.

Source: U. S. Census of Manufactures (42).

Corn oil is extracted from the germ stock by the expeller process. The principal byproduct feed from dry corn milling is hominy feed, a mixture of the hull, gum, and starchy portion of the kernel. Hominy feed is used by mixed-feed manufacturers and is sold in competition with corn at a price closely in line with the price of grain. Gum cake is the resulting product after the oil has been pressed from the germ; germ meal is the ground germ cake.

Food uses account for the greater proportion of the dry milling industry's output with the remainder going into nonfood industries. The principal food outlets have been cornmeal, grits, and breakfast cereals. Chief nonfood uses are as core binders in making metal castings and as adhesives.

#### Distilling and Fermentation Industries

The principal grains used in the United States in preparation of distilled liquors are corn, rye, and barley malt. In addition, some oats and wheat are used.

In the United States, the chief products of distillation are bourbon, rye, and corn whiskey. Corn and barley malt are the principal elements in bourbon whiskey. Ordinarily some rye is also used, but to be classed as bourbon, at least 51 percent of the grain used must be corn. The same ingredients in different proportions are generally used in preparation of corn whiskey.

Another important product of distillation is high proof alcohol, or neutral spirits, which is used in preparation of gin and cordials, in blending, and in certain technical uses.

Before World War II, ethyl alcohol was principally derived from molasses, although some plants used corn. During World War II most of the alcohol was produced from corn and wheat fermented by industrial and converted beverage alcohol plants.

Corn is a major raw material used in making distilled spirits for beverage purposes. Several processes may be used to manufacture alcohol from corn. The grain residue from the fermentation process is used in manufacturing livestock feeds.

Fermentation and distillation remove only the starch from the grains. The remainder is a product richer in yeast proteins, fats, and vitamins than the original grains. Recovery of feed in the distilling process yields about 17 pounds per bushel of corn processed (8).

#### PRICES AND FARM-RETAIL SPREADS

Between 1950 and 1964, the average retail price of cereal and bakery products rose 39 percent while per capita consumption of flour declined about 15 percent. Among the major food groups, this price increase was second only to the 46 percent rise for fruits and vegetables.

Prices of all cereal and bakery products increased during this 15-year period. The largest increase was for corn flakes--up 80 percent. Increase in cornmeal prices was about 62 percent in the same period. The price of white bread increased 45 percent, not much more than the entire cereal and bakery products group. The price increases for rice, up 29 percent, and for wheat flour, up 15 percent, were the least in the group.

According to past statistical studies, there appears to be little relationship between changes in retail prices and the quantities of cereals consumed. One reason for this appears to be that data on quantities of cereal consumed refer only to cereal components of the final product, whereas data on retail prices refer to consumer products which include other ingredients. Since marketing activities accounted for such a large part of the consumer's dollar spent for cereal and bakery products--80 percent in 1964--trends in wage rates and prices of other marketing services may be expected to affect retail prices more than does consumption of cereal products.

The farm-retail spread for farm-originated foods declined 1 percent in 1965, the first contraction since 1950. However, retail cost and farm-retail spread for the bakery and cereal products group each increased slightly between 1964 and 1965, less than 1 percent. The farm value increased almost 3 percent. The increase in farm-retail spread was about the same in 1965 as in 1964, but smaller than for the other years of the 1960's. In 1965, retail costs, farm value, and farm-retail spread were each up 8 percent from the 1957-59 average.

Farmers' share of the retail cost for all farm food products increased from 39 percent in the 1957-59 period to about 40 percent in 1965. During this same time the farmers' share for bakery and cereal products remained the same at 21 percent of the retail price.

## FUTURE PROSPECTS

Total disappearance of all grains will continue to expand but rate of expansion will vary among grains. Also, shifts in market outlets and changes in market structure will differ.

Most of the increase in the demand for food grains will be accounted for by a further expansion of exports. A continued moderate increase in demand in foreign developed countries and a probable substantial increase in shipments to under-developed areas should provide the basis for a steady rise in foreign shipment of food grains. On the domestic side, population growth will continue to be the dominant factor in increased consumption. The long downtrend in per capita consumption of food grains appears to have been checked but considering consumer preferences for other foods, and the expected continuation of high levels of personal incomes, prospects for substantially increasing per capita demands are not favorable. Further substantial increases in industrial uses of food grains likewise appear limited.

In contrast, domestic demand for feed grains is expected to increase more rapidly than foreign demand. The domestic demand will be bolstered by increases in both livestock feeding and industrial use. With continued high levels of income, total domestic demand for livestock and livestock products may be expected to increase somewhat more rapidly than population. By 1980, domestic use of livestock products is expected to be about 40 percent above the 1959-60 average. While expansion in livestock production will account for the major part of the increase in demand for feed grains, expected favorable livestock-feed price relationships will encourage production of a larger proportion of grain-fattened beef and a more rapid increase in feed use than in livestock numbers. Thus, it appears that domestic use of feed grains in 1980 might be as much as 50 percent over the 1959-60 average. Exports of feed grain especially to Western Europe and Japan, are expected to expand, where rising incomes have increased the demand for livestock production. Also, livestock producers in these areas, as in the United States, are increasing feeding rates.

Some grains commonly referred to as feed grains are also used for human consumption. Some increase is likely in exports of these grains to underdeveloped countries for food use. However, any substantial increase will depend upon the development of higher protein grains and acceptance of such grains in the diet.

Existing facilities are more than adequate to handle expected increases in both food and feed grain supplies in the near future. Increased volumes of grain received and shipped will tend to increase efficiency in handling at country, inland terminal, and port terminal elevators. As market demand more nearly approximates the volume of production, food and feed grain stocks cannot be expected to accumulate much above present relatively low levels. Thus, the volume of grain storage presently built is more than is needed and will slowly be reduced to more nearly reflect future carryover needs.

In recent years, U.S. wheat-flour mills have been operating at over 90-percent capacity. Domestic flour demand, reflecting the expected population growth, should increase about 20 percent in the next 15 years. Foreign demand also may increase. Therefore, flour milling capacity will need to be expanded 15 to 20 percent above present capacity by 1980. Similar increases may be expected in rye and barley processing facilities. Present food consumption trends indicate that facilities for processing rice, corn, and oats may need to be increased at a somewhat faster rate.

Commercial grain producers are expected to continue to increase in size and further integrate some marketing functions into their operations. Livestock and poultry producers also are expected to continue to grow in size, and further shifts toward consuming centers may occur. As production units increase in size, the number of producers manufacturing their own feed will increase. Many of the larger units will produce a large proportion of the grain required for feeding. On-farm drying will be expanded and farm storage will be increased in some areas.

#### SUMMARY

Grain marketing has changed as a result of larger farm production units, technological advances in harvesting grains, improved transportation, changes in marketing channels to increase efficiency, Government programs, and changing demands of grain consumers. Technological advances in farming and farming methods have brought forth increased farm output per man-hour, increased farm production, and a decrease in number of farms.

Grain moves in several directions from the country elevator: to terminal elevators, subterminal elevators, or processors. These channels have changed over time with individual firms performing more than one operation, and these changes have tended to expedite grain movements as well as reduce the overall cost of handling.

The organization and operation of grain-marketing industries have been changing rapidly. Significant shifts have taken place in the location of grain production, in both domestic and foreign demand for grain, and in the technology of handling, transporting, and processing grains for food and livestock feeds. Changing institutional policies and practices include shifts in country and terminal market channels and in the grain storage and merchandising activities of the Commodity Credit Corporation. Market structure changes are reflected in plant consolidations and acquisitions, and mergers by competing firms; shifts in number, location, and types of operation of plants; diversification of plants and firms; and integration by marketing firms.

Off-farm sales of grain increased greatly in 1939-64. In 1939, about one-third of all grain produced was sold off farms, and by 1964 this had increased to almost two-thirds. The average country elevator increased its volume handled fourfold, while the total number of country elevators decreased about 15 percent.

Number of terminal elevators increased about two-thirds between 1948 and 1963, with most of the increase in the North and South Central Regions. There was a noticeable shift in the ranking of major terminal markets (according to volume handled) during this period. During the 1963-64 marketing year, about 80 percent of the wheat and 50 percent of the feed grains passed through subterminal and terminal markets.

In the 1963-64 marketing year, about 1,378 million bushels of wheat moved through the marketing channels. The percentage of wheat going to flour millers decreased from 86 percent of the total crop in 1939 to 41 percent in 1963-64. Larger quantities of wheat exports accounted for this decrease.

Rice moves directly from the farm to the dryer or the mill where it is processed. The milled rice is shipped to packagers and wholesalers for domestic distribution, or to exporters. Rice exports increased between 1939 and 1963; in 1963 they accounted for almost 60 percent of total disappearance.

In 1963-64, about two-thirds of all feed grains were channeled into the prepared feeds industry. This quantity was slightly more than double the quantity used by the industry in 1939.

Both country and terminal elevators use the futures market for protection against loss due to price fluctuations. The country elevator tends to use the "to arrive" or "on track" sales to offset cash purchases. Futures are also used by the country elevator in hedging grain kept in storage. Elevator operators tend to be short hedgers, selling futures shortly after purchasing the grain. Some pre-hedging is done by elevators if they anticipate large receipts overnight.

U.S. exports of wheat and flour averaged about 39 percent of world exports for the period 1955-56 to 1964-65. Exports of wheat under Government programs accounted for between 59 and about 78 percent of total U.S. exports in this period. The low and high years were 1963 and 1964, respectively. Value of U.S. exports of wheat and flour made up 20 percent of all agricultural exports in 1963-64.

Rice exports increased greatly from 1955 to 1962 due to Government programs. From 1954-55 to 1964-65, exports under Government programs accounted for 45 to 60 percent of total exports. However, in recent years, increases have come from commercial sales.

Exports of feed grains have increased recently due to more animal units fed and greater quantity fed per animal unit. U.S. exports of feed grains averaged 49 percent of world exports of feed grains for the last 7 years. Fluctuations of U.S. exports of feed grains have resulted primarily from changes in availability of supplies in competing countries. In terms of value, feed grains have accounted for about 11 percent of all U.S. agricultural exports.

Grain processors obtain the bulk of their grain supplies from country and terminal markets. However, those processors located in grain areas draw a portion of their needs directly from the farm. In general, the number of processing establishments

has decreased since 1939. The decrease in plant numbers has been accompanied by an increase in plant efficiency and an increase in output per man-hour.

The average retail price for cereal and bakery products increased 39 percent from 1950 to 1964. Between 1964 and 1965 the retail price and farm-retail spread increased less than 1 percent. Retail cost, farm value, and farm-retail spread were about 8 percent higher in 1964 than the 1957-59 average.

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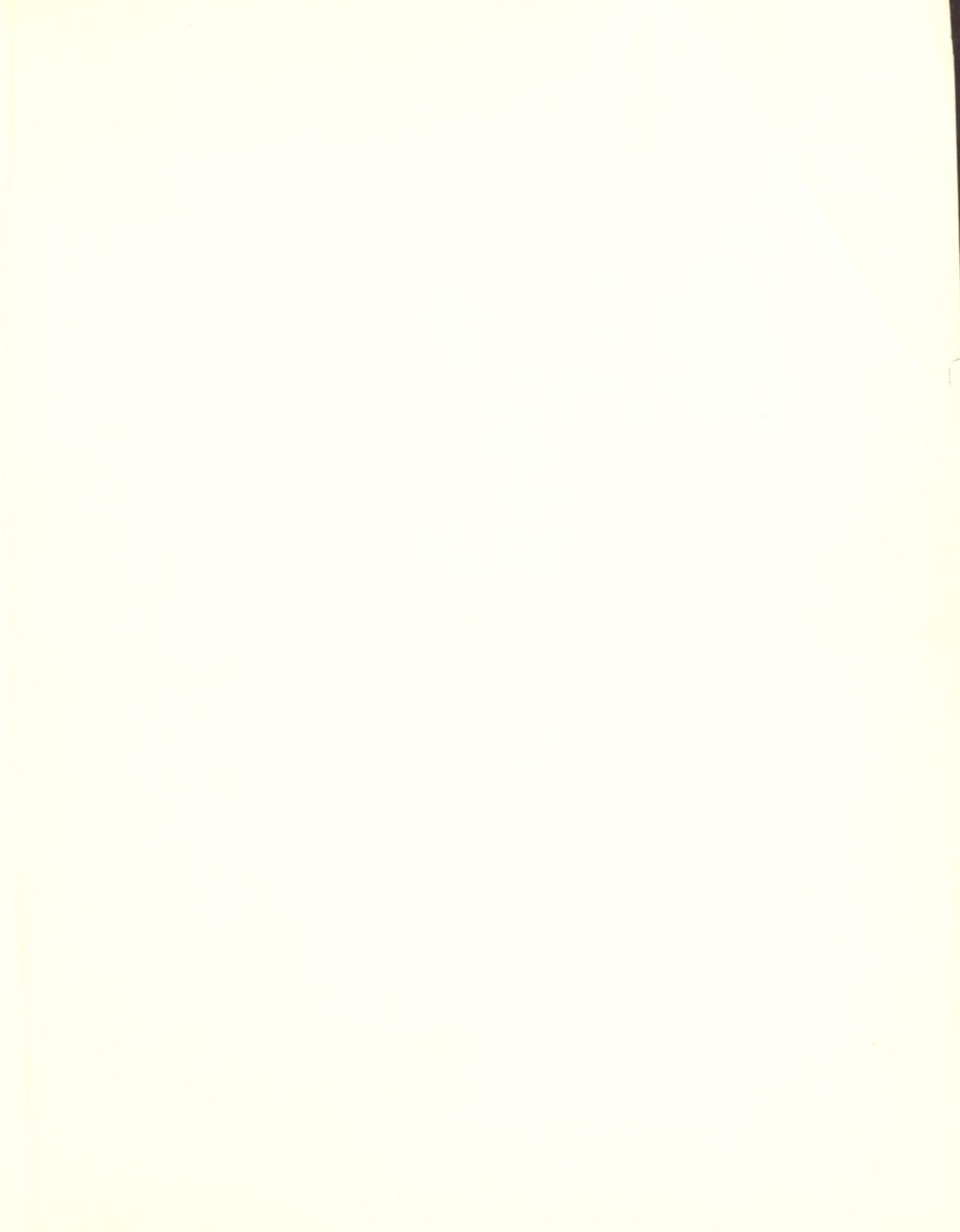
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